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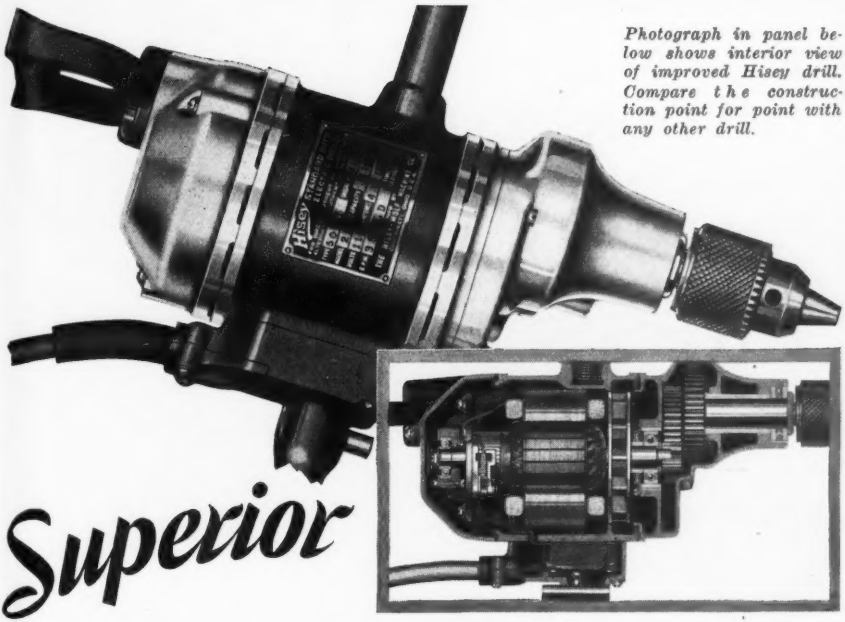

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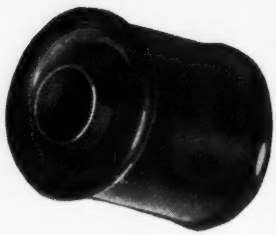

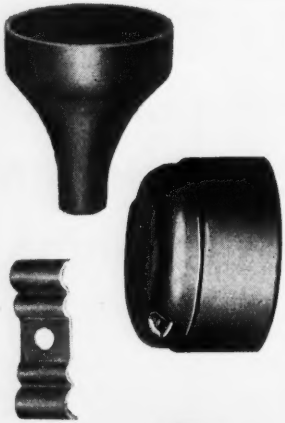

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K&T Production Service Engineers, because of their broad knowledge of milling practice and their proven ability to economically apply Milwaukee Milling Machines to every milling job, are well qualified to solve your milling problems.

KEARNEY & TRECKER
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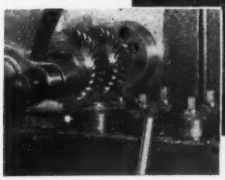

The large number of Milwaukee Milling Machines in the mammoth plant of The Maytag Company present a remarkable picture of Milwaukee production efficiency in the general manufacturing field.

Pictured here is a No. 2 Standard Universal Milwaukee Miller set up for squaring the ends of Maytag worm wheel shafts A special fixture with eight indexing units, each unit holding one piece, assures economical production.

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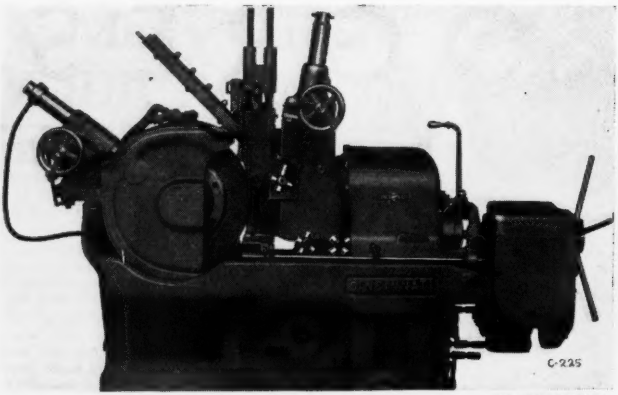

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This development shows how our service engineers co-operate with customers in working out more economical grinding methods. For a profitable solution of *your* grinding problems, call on our service engineers. There's no obligation.

This is the ninth of a series of advertisements showing Centerless Grinder developments. Watch for the next message on this page.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI, OHIO U.S.A.

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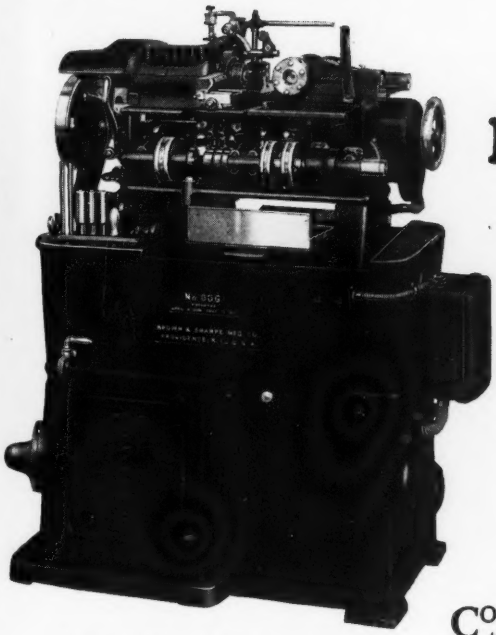

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A spindle, for light work, with $\frac{7}{16}$" capacity can be furnished, if desired, at a slight additional cost.

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...Greatly Increased Range of Speeds...

...for Steel as well as Brass...

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COMBINING the features of both the regular and high speed machines—an added range of speeds and feeds offering new flexibility of operation and control—the Brown & Sharpe No. OOG Automatic Screw Machine (High Speed) (For motor drive only) NOW covers an unusually broad field of production possibilities.

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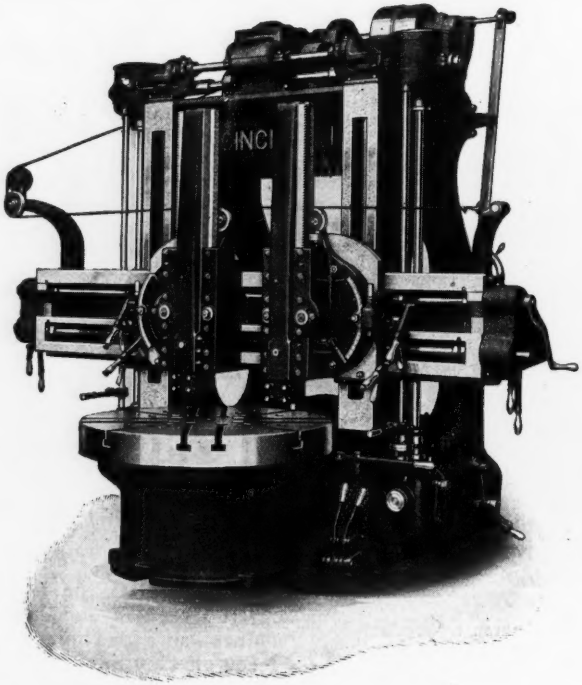

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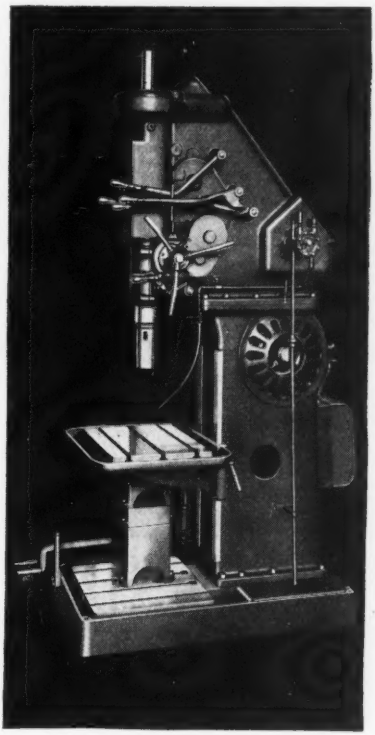

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Our recent announcement of the new Universal Gear Shaper is recognized as an outstanding achievement. It marks an epoch in industry.

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MODERN Machine Shop
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A Magazine for Machine Shop Executives
HOWARD CAMPBELL, Editor

Vol. 3 JULY, 1930 No. 2

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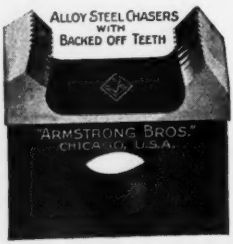

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Write for Catalog B-27. Shows, describes and prices all ARMSTRONG Tools.

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MODERN Machine Shop

JULY, 1930

CINCINNATI, OHIO VOL. 3, NO. 2

Producing Valves in a Modern Plant

By DONALD A. CLARK

THE valve is one of the simplest forms of mechanism, but upon the lowly valve hangs—in many cases—great responsibility. Its task is simple, but failure to perform this task properly may result in loss in comparison to which the cost of the valve is insignificant. It is easy to understand, therefore, why the manufacture of valves at the plant of the Wm. Powell Company, Cincinnati, Ohio, involves the use of modern equipment.

The output of the Powell plant is divided quite evenly between bronze, cast iron and steel. Most of the iron used is of a fine grade containing ¾% nickel, the nickel tending to refine the structure of the metal, eliminating porosity, and facilitating machining. Recently a new alloy known as "KA-2" has been used, containing 18% chromium and 8% nickel. Monel metal, nickel bronze, aluminum bronze, aluminum and pure nickel are also used for regular production.

The foundry equipment for the non-ferrous division includes eight electric furnaces, each of which has a capacity of 400 pounds. The furnaces are arranged in two groups as shown in Fig. 1, three retorts for preheating

Fig. 1—The non-ferrous metals are melted in these electric furnaces.

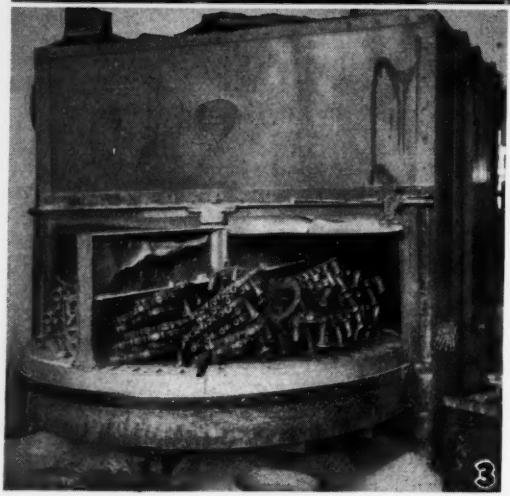


Fig. 2—The molding room. The sand is automatically conveyed, riddled, tempered, and conveyed again to the hoppers from which it is drawn by the molders. Fig. 3—This sand blast room with rotary table provides for continuous operation.

the ladles, shown at the right in the illustration, being accessible to either group. The usual schedule calls for 2,800 pounds of metal to be poured in each 30-minute period. It is planned to keep all of the furnaces in operation continuously, allowing one furnace to be out of commission at a time for cleaning or for repairs. The sand is automatically conveyed to the molders, who draw it as needed from the fifteen hoppers shown in Fig. 2. Each hopper is located directly over a molding bench. After the molds have been poured and have cooled sufficiently, they are dumped over gratings in the floor through which the sand falls on to a conveyor that carries it to the riddles at the opposite end of the foundry. Here the good sand is sifted out and conveyed to a hopper where it is mixed with new sand and tempered for use, then it is conveyed to the hoppers over the molding benches, from which it is drawn for new molds.

After the castings have cooled, they are sand blasted with the sand blast equipment shown in Fig. 3. This outfit consists primarily of a steel-walled room containing the sand blast ma-

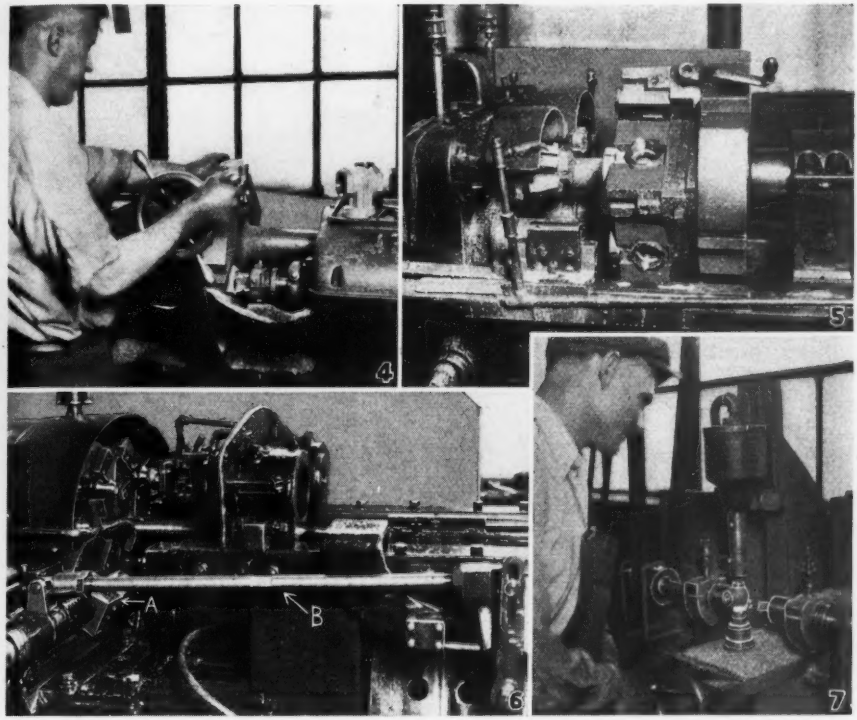
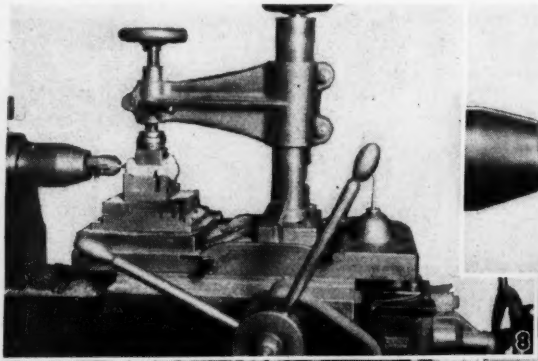


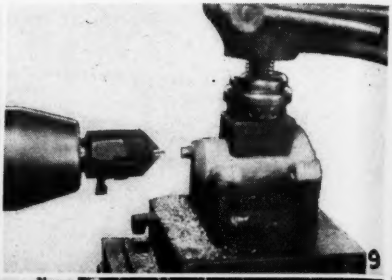
Fig. 4—Machining valve bodies in a double head turret lathe. Fig. 5—The right angle connection of the valve is machined in this five spindle automatic machine. Fig. 6—A five spindle automatic with auxiliary attachment for turning radial seat on disks for globe valves. Fig. 7—Air operated equipment provides for quick and easy clamping.

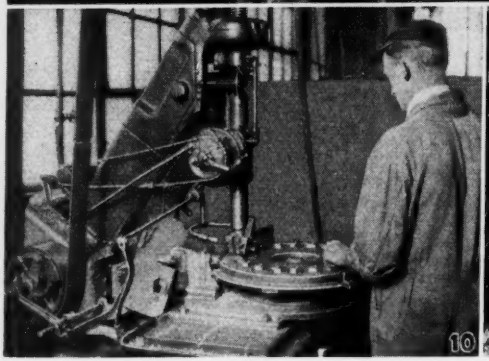
chine and having a rotary table set into one wall. A walled section divides the table through the center so that half of the table is inside the sand blast room while the other half is outside. Thus with one operator in the sand blast room and another outside to unload and reload the table, the operation of sand blasting can be made practically continuous, with loss of time only for indexing the table. The castings shown on the table are valve bodies, a lot of material of this size requiring approximately twenty minutes to sand blast.

Bronze valve bodies and other castings that are to be subject to high pressure are given a special heat treatment which increases the strength of the bronze approximately 8,000 lbs. per square inch.

Valve bodies of the ordinary size are bored, faced, and tapped in a double head turret lathe shown in Fig. 4. Each head carries two spindles and the work turret has three chucks so that while the operator is changing pieces in one chuck, two combination tools are boring and facing the pieces at the second station and the third piece is in process of being tapped. Valves of the 2 in. size, such as those shown in process, are finished on this operation at the rate of 100 per hour. Smaller sizes are produced at a rate of 200 per hour.







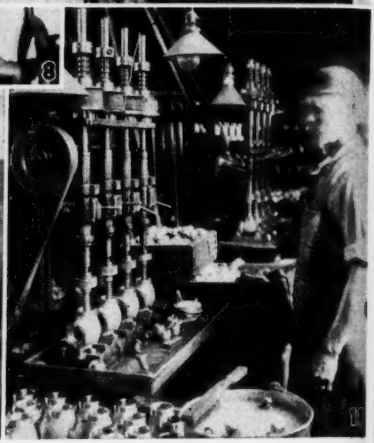


Fig. 8—Here the tool is held in the head stock spindle and the work is clamped on the slide. Fig. 9—Close-up view of the work and tool shown in Fig. 8. Fig. 10—The automatic operation of the rotary table on this Barnes drill makes it possible to face 700 valve packing nuts per hour. Fig. 11—Grinding-in valve seat discs.

The right angle connection or "neck" end of the angle valve is machined in the five-spindle automatic machine shown in Fig. 5. This machine has four spindles and a work turret which holds five pieces. While the operator is changing the finished piece for a rough one, the first tool is boring half way in the hole, the second tool is finish boring another piece, the third tool is facing another and a tap on the fourth spindle is cutting the threads.

Fig. 6 shows a five-spindle New Britain automatic machine set up to turn, face and form discs for globe valves. The radial surface which seats in the valve is formed by a tool held in the tool block indicated at **A**. The tool block is attached to a shaft that is connected to the bar **B** which is attached to the turret. At a given point in the motion of the turret toward the headstock, the bar **B** is pulled backward, thus revolving the shaft and giving the tool the radial motion which is necessary to the forming of the disc. As most of the wear in a valve comes on this disc and its seat, these parts are made of special nickel alloy called "Powellium," which is very hard. The tools are of carboloy, with which a production of eighty-five pieces per hour is possible, as compared to forty-five per hour with the tools which were used previously.

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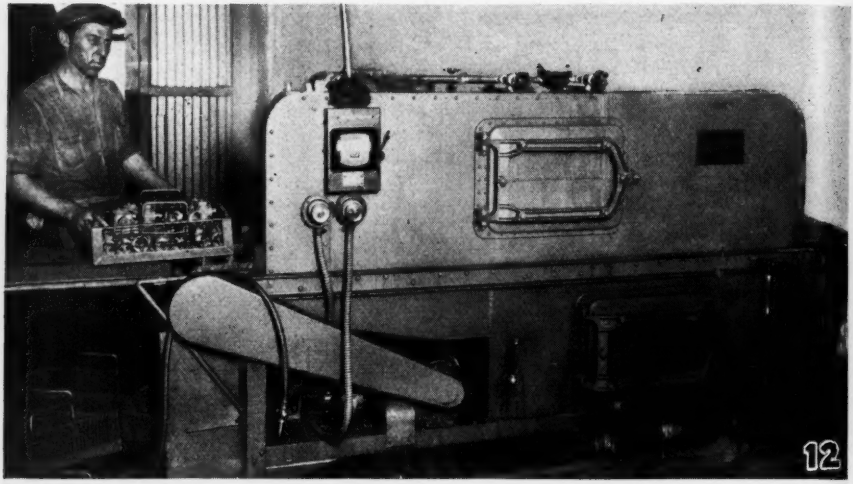


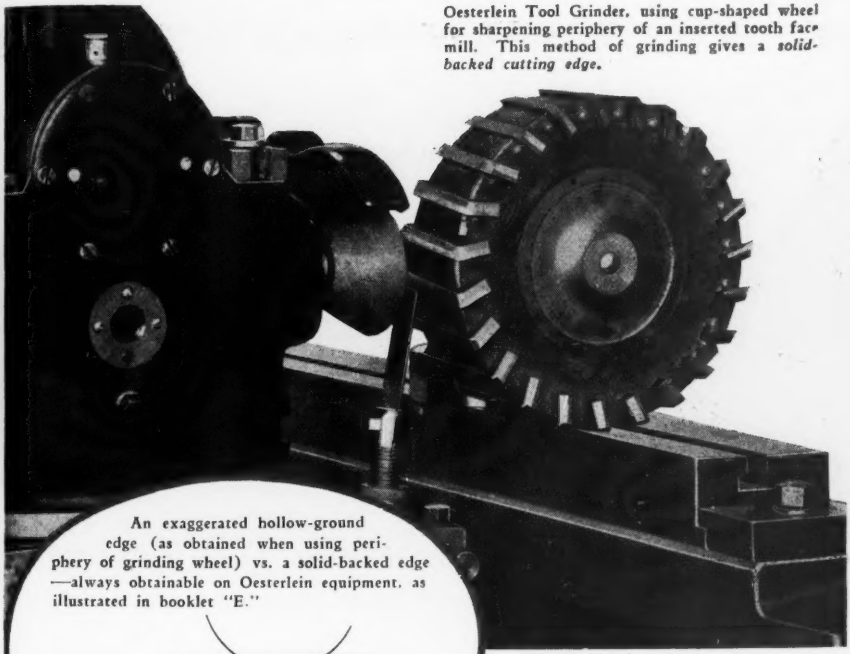
Fig. 12—All valve parts are thoroughly cleaned in this automatic washer before the final assembling.

The equipment illustrated in Fig. 7 shows one of the many ways in which air is utilized to reduce non-productive time to the minimum. The valve shown in the machine is of the type on which a hexagon is milled so that a wrench can be applied. Two end mills are employed, located at the proper distance apart, and the work is held between a spindle—which can be indexed—and the ram of an air cylinder that is mounted on the cross-slide. A slight movement of a lever clamps the pieces in place and the action of feeding the work back after milling indexes the work spindle.

The illustration Fig. 8 shows a machine in which the tool is held in the headstock spindle and the work is clamped on the slide. The slide can be operated in both longitudinal and lateral directions, the cross-slide being controlled by the hand wheel at the end of the machine, as shown. This arrangement makes it possible to perform the same operation on the inlets on both sides of the casting. A view of the tool and work is shown in Fig. 9.

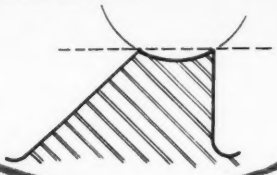
The machine shown in Fig. 10 is a Barnes drill equipped with a rotary table, used to face valve packing nuts. The operation is entirely automatic, the rotary movement of the table being controlled from the spindle by means of a chain and sprockets so that the upward movement of the spindle, after the facing of each piece, indexes the table. Thus the operator's attention is confined to the task of changing the pieces in the fixture, which, as the production is 700 pieces per hour, keeps him busy.

In Fig. 11 is shown a part of the line of machines in which the valve discs are ground-in to their seats. An air and water tight joint must be produced before the valve is considered finished. After grinding, the valves are disassembled and thoroughly washed in a boiling hot solution in the automatic washer shown in Fig. 12. They are then ready for assembly. All pressure products are given a hydraulic test of 3½ times their rated steam pressures, and where special testing is required—such as actual steam or air testing—the test is carried out according to specifications.



Oesterlein Tool Grinder, using cup-shaped wheel for sharpening periphery of an inserted tooth face mill. This method of grinding gives a *solid-backed cutting edge.*

An exaggerated hollow-ground edge (as obtained when using periphery of grinding wheel) vs. a solid-backed edge—always obtainable on Oesterlein equipment, as illustrated in booklet "E."



Cutters Last Longer When Ground with a Solid-Backed Edge

AN outstanding feature of Oesterlein Grinders is the ease with which a cup-shaped wheel can be applied to the grinding of all types of cutting tools. This cup-shaped wheel grinds a straight-line clearance—resulting in a stronger solid-backed cutting edge that has twice the life of any hollow edge.

The sketch above shows the right and wrong way of grinding face mills. The photograph above shows correct set-up on an Oesterlein Grinder for grinding face mills in a way that means ***better cutting and longer life.***

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Now Regulated as Well
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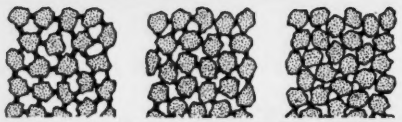
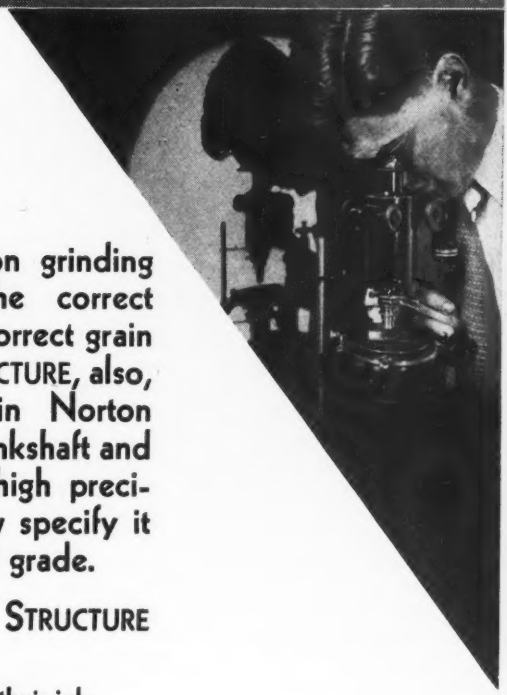


A diagramatic sketch showing how three wheels may be identical in grain size and in grade (bond strength) but differ in grain spacing or STRUCTURE— and thereby differ in grinding action.



Modern high production grinding requires more than the correct abrasive and bond, the correct grain and grade. Wheel STRUCTURE, also, must be right — and in Norton wheels for centerless, crankshaft and other high production, high precision work, you may now specify it just as you do grain and grade.

NORTON CONTROLLED STRUCTURE makes possible:

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2. Closer duplication of wheels.
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A booklet completely describing the new marking system will be sent upon request.

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GRINDING WHEELS

Quality Club Promotes Quality of Master Motors

By M. L. Turner

THE development of an electrical or mechanical design is a task for the designing engineer. The manner in which the designer's ideas are given concrete form to meet the needs of the consumer is very largely the responsibility of the manufacturing department. In the modern industrial plant it is not unusual to find a lack of co-operation between these two departments—many times to the point where quality is suppressed.

The Master Electric Company, Dayton, Ohio, took steps several years ago to eliminate this discrepancy and to promote an added stimulus to better quality by the formation of an executive organization which is known as the "Quality Club." The Quality Club is not a training school; rather, it provides a means for co-operation between the department heads by bringing them in contact in a way which is impossible in the ordinary routine of the day's work. The functioning of this Quality Club has been so outstanding in co-operative results and in producing a constant refinement of quality in the product that Quality Clubs modeled upon the lines of the Master Electric Quality Club have been formed in a number of other plants throughout the country.

The personnel of the Quality Club is composed of the heads of all departments that are in any way responsible for quality, including the President of the Company, Mr. E. P. Larsh, and Vice-President, Mr. W. R. Clements. Immediately after lunch, once a week, the club goes into session in the factory dining room. The meeting is presided over by Mr. Clements, who has charge of all sales activities of the company and is in close touch with the field. Notices of important matters that are to come before the club are distributed to the members several days in advance so that they can be prepared to offer suggestions or solutions.

The various matters that come before the club include:

1—Suggestions that have been received through the plant suggestion system.

2—Proposed changes in designs.

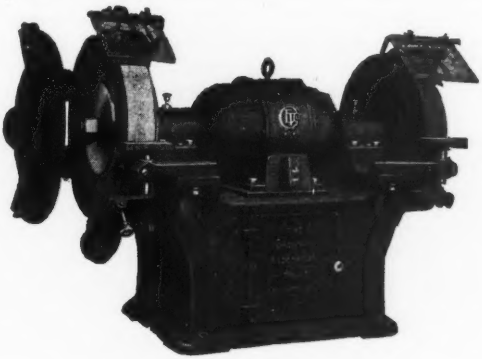
3—Report by the engineering department on changes that have been made and tested out.

4—Field complaints received from customers or company salesmen.

5—All matters of general interest to the group.

All these are read before the assembly and each in turn is taken up for discussion. If the discussion under advisement calls for the redesign of a part, each of the executives who are concerned with the machining of the part has an opportunity to offer suggestions which may have a bearing on the tooling, the ease, speed, or accuracy of machining, or other factors with which he may be directly concerned. If the matter is one of defective workmanship, the responsibility can easily be placed. If it is a discussion of an engineering change, it gives the tool supervisor, the tool room foreman and manufacturing department heads advance notice concerning the change in the product, changes in tools and methods, or changes in the scheduling system.

As a subsidiary function in improving quality a committee of representa-



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It is built like a six-foot, two-fisted he-man ... the perfect grinder that will stand the gaff on heavy duty work in the foundry, railroad shop, steel mill and other plants where continuous service is required.

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- ***—Safety Starters with Push Button Control***
- ***—Adjustable Wheel Guards***
- ***—Non-breakable Eye Shields***
- ***—Chip Breakers***
- ***—and many other features.***

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DIVISION OF THE R. K. LeBLOND MACHINE TOOL CO.

tives from both the manufacturing and engineering departments select, each week, twenty motors of various kinds and sizes from among those that are being placed into stock. These twenty motors are all checked over in the engineering department. Tests are made at given loads, overloads, for grounds, and some are given "breakdown" tests. If any of these motors fail to pass the test and thus fall below the high standard of quality which is being maintained, such motors are turned over to a committee composed of the chief inspector, chief engineer, test foreman, assembly foreman, and motor inspectors, who examine them and place the responsibility for "under par" workmanship. Reports are made on the twenty motors and these reports are brought up for discussion at the next Quality Club meeting.

Just as the "Master Motor Quality Club" functions to improve quality of product, so the "Motor Masters Club" functions to improve the efficiency of the personnel. The Motor Masters Club takes in a wider scope than the Quality Club and comprises in its membership all key executives in the organization. Meetings are held monthly and are preceded by a dinner furnished by the Company. At these meetings, which are for the most part educational, the feature of the evening is usually a talk by a prominent engineer or manufacturing executive from some other well known company, or an educational film. Pictures shown thus far during the 1930 season have included films involving the manufacture of bakelite products, bearings, manufacture of steel, and others designed to give the Club members a clear idea of just what takes place in other manufacturing plants where the raw materials that go into the manufacture of Master Motors are obtained. These meetings have also been addressed by speakers who are well known industrial figures from time to time. Once or twice each year the wives and feminine friends of the members are invited to partake in a banquet and entertainment sponsored by the Club. At these functions the family spirit is fostered and personal friendships are developed.

The successful operation of such organizations as the "Quality Club" and "Motor Masters Club" involves a certain amount of expense, borne by the firm, and a considerable amount of concentration of effort on the part of the executives of whom the club is composed. According to Mr. Larsh, however, the expense and effort are more than justified by the results. Mr. Larsh says: "These clubs provide a much needed opportunity for the heads of the various departments to get together at regular intervals, refresh their minds as to the ideals toward which we are all working, realign their mental aim toward a common objective, iron out any misunderstandings and obtain a clear picture of just what is taking place in the progress of the company and in the development of the product. The natural sequence to these meetings is a brand of co-operation which is regarded by us as an important factor in the success of the company."

Hammond Bulletin No. 20

Bulletin No. 20, issued by the Hammond Machinery Builders, 1622 Douglas Avenue, Kalamazoo, Michigan, illustrates and describes the Hammond grinding and polishing machines in which the Hammond Motor Air Cleaner is incorporated. These machines include tool grinders, production grinders, casting snaggers, combination disc and production grinders, double disc grinders, motor-on-spindle polishers, twist drill grinding machines, ring wheel grinders, multi-speed casting grinders, and combination grinders and buffers.

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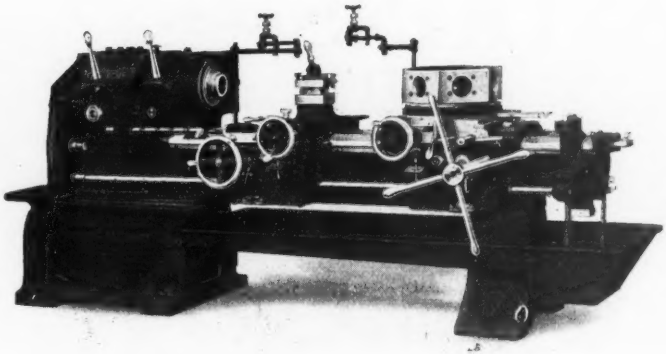

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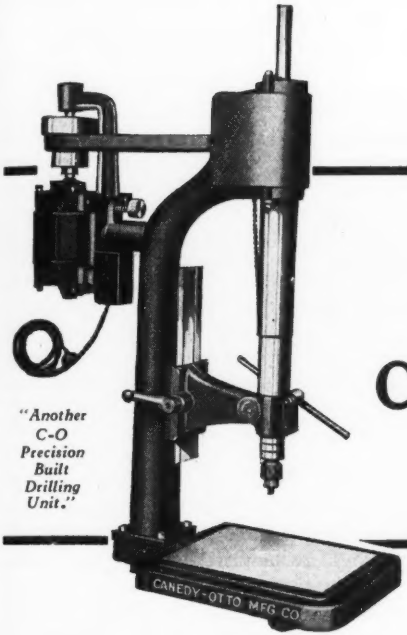

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Locomotive Piston Rod Extractors

By H. H. HENSON

THE inspection of locomotives is more thorough and more systematic today than ever before. On some railroads, the inspection system requires that piston rods and valve stems shall be extracted and hammer-

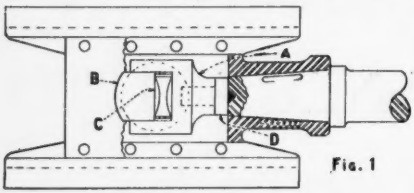

Fig. 1—Piston Rod Extractor Assembly, Style "A."

tested for cracks or loose fits once every three months. The removal of the piston rods from their crossheads for this test can best be accomplished with extractors designed especially for that purpose. The extractors shown in Figs. 1, 3, and 5 have proved so efficient and satisfactory that the writer can unhesitatingly recommend their use.

The tools shown here are adapted for extracting piston rods that are secured in place by the use of either keys or nuts. The details of the extractor illustrated in Fig. 1 are shown in Fig. 2, this extractor consisting of the plunger **A**, thrust pin **B**, wedge **C**, and plunger extension **D**. When placing these parts for extracting a piston rod, the plunger extension **D** is placed in position first, then the plunger extension and thrust pin are located with the wedge between them. The operation of driving the wedge in with a sledge spreads the parts **A** and **B** apart, forcing the piston rod loose. Five plunger extensions **D** of different lengths are provided in order to accommodate the various types of crossheads, the lengths of the extensions, indicated as **X**, being ½ in., ¾ in., 1 in., 1¼., and 1½ in. respectively.

The extractor shown in Fig. 3 is practically identical with that shown in Fig. 1 insofar as the design is concerned, excepting that the plunger dimension **X** is different. The details and dimensions of this extractor are shown in Fig. 4. The taper of the wedge is ⅝ in. in 18 in., instead of ¾ in. in 18 in., due to the fact that this extractor is intended for use in a heavier type of crosshead. This extractor is very powerful and will force

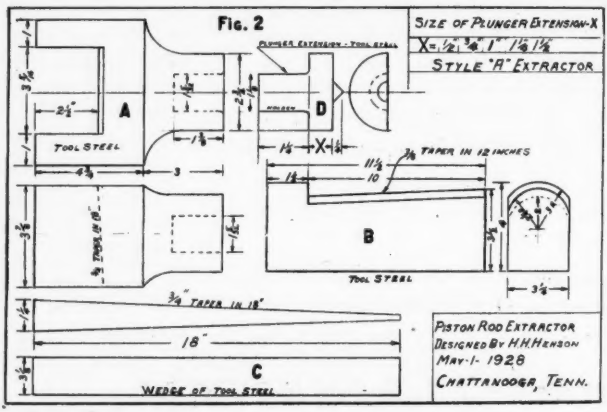

Fig. 2—Details of Piston Rod Extractor Shown in Fig. 1.

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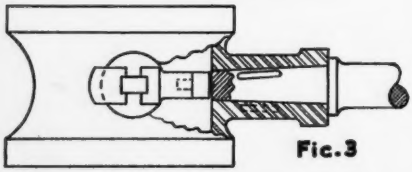


Fig. 3—Piston Rod Extractor Assembly Style "B."

out any size or kind of piston rod when the wedge **C** is driven in without requiring the crosshead to be heated with a blow torch.

The extractor shown in Fig. 5 is simple and powerful but can be used only on crossheads having draw key slots. This type of extractor is very convenient, as it permits the piston rod to be extracted without disconnecting the main rod from the crosshead. This tool consists of the front thrust gib **A**, the back thrust gib **B** and the tapered wedge **C**, these members being dimensioned to suit the type of crosshead from which the rod is to be extracted. The thickness of the parts is determined by the width of the keyway. The gibs and wedge are given a taper of 5/8 in. in 18 in. In using, the front gib **A** is inserted in the key slot of the piston rod, next to the piston head, and the back gib **B** is inserted in the slot in contact with the crosshead, as shown in the illustration. Then the tapered key **C** is inserted between the two parts **A** and **B**. By forcing the key down between the gibs—which is usually done with a sledge—the piston rod is loosened so that it can easily be removed. This extractor will draw any type of piston rod that is anchored in the crosshead by a tapered key.

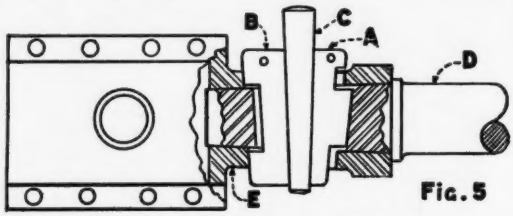


Fig. 5—Piston Rod Extractor for Crossheads Having Draw Key Slots, Style "C."

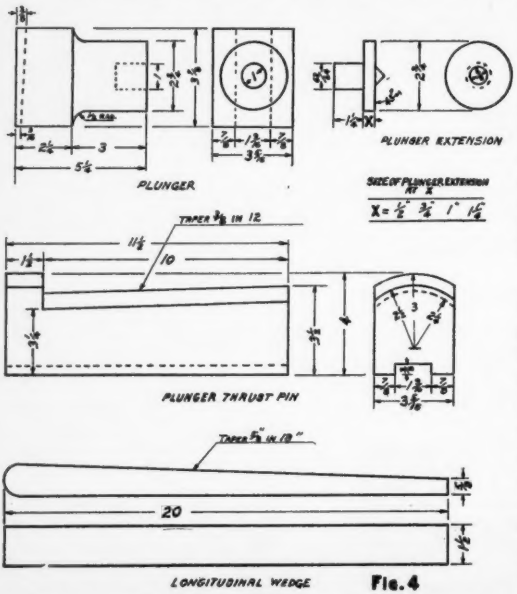
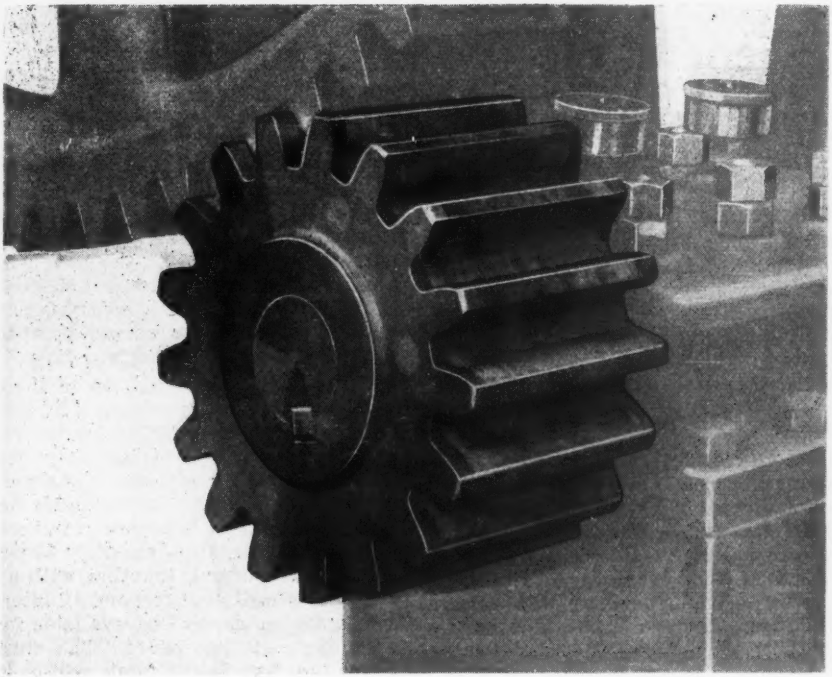


Fig. 4—Details of Style "B" Piston Rod Extractor.

A good quantity of tool steel is required for making the parts and care should be exercised in tempering and hardening. If the parts are made too hard they will break; if they are not hard enough, they will tend to rough up and will not "kick" the rod out as they should. These extractors can be made in any toolroom, and will be found more efficient than many of the extractors that are now on the market.



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General Electric Company Inaugurates Unemployment Fund Plan

AN unemployment relief plan for General Electric workers, designed to make funds available for employes during times of need or unemployment, has been announced by President Gerard Swope. The money will be raised through equal contributions by the employes and the company. Many provisions in the plan are an outgrowth of suggestions from committees of leading workmen.

At the same time Mr. Swope announced a plan for the stabilization of employment by reducing to a minimum the cause and effect of unemployment. Rules are set down for all factories as to what to do and what not to do when business is either on the increase or when work is falling off.

The unemployment plan may be adopted by any works, regardless of the action of the other plants, and the company will participate upon an affirmative vote of 60 per cent or more of the eligible employes of that works. Any employe with continuous service with the company of one year or more is eligible for membership. By enrolling, the participant agrees to pay into a trust fund created by the plan approximately one per cent of his actual weekly or monthly earnings for a period of three years, but only so long as his earnings are 50 per cent or more of his average full time weekly or monthly earnings.

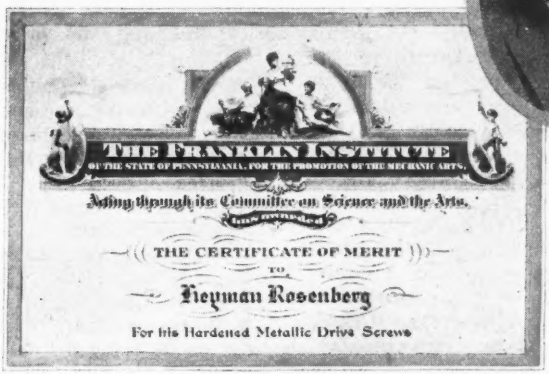
In times of poor business and consequent unemployment, normal contributions by participating employes would cease and all employes would be called upon to contribute. In other words, employes who are subject to lay-offs would aid themselves as much as possible, and when they could no longer do this, then those employes who are still working would contribute toward the aid of the men who are laid off, while the General Electric Company would, itself, contribute in both instances to an extent equal to that of the participating employes.

According to the plan, up to three per cent of the contributions paid into the trust will be available for the relief of employes or former employes in need; up to 27 per cent of the normal contributions will be available for loans to employes who are members, and the balance, approximately 70 per cent of the normal, together with all emergency contributions and all interest on the funds, will be available for unemployment payments. The trust which will handle the funds will be in charge of a board of trustees and the General Electric Company will guarantee five per cent interest. The company will also pay the administration expenses for the first two years.

The plan will operate separately in each works, and its administration in each works will be vested in a board of not less than four or more than 16 members, half of which will be elected by the participating members and the other half appointed by the General Electric Company. No payments will be made from the fund for at least six months after its creation and thereafter only to employes who have made normal payments for at least six months. Payments to contributing employes who receive notice of a temporary lay-off shall be 50 per cent of their average earnings for full time, but in no case more than $20 per week, and such payments shall not

In Recognition

of a notable contribution *to the* Mechanic Arts . . .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Enormous economies of assembly time and labor have been made possible by these unique Screws which are so hardened and threaded that they tap their own thread in metal as they are driven. Slow and expensive tapping, for 1500 years necessary to the assembly of metal products with screws, is no longer required for hundreds of assemblies.

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2. *Hardened Self-tapping Sheet Metal Screws*—*Type "A"* . . . are turned into drilled, pierced or punched holes with a screwdriver. They are used for joining sheet metal and making fastenings to sheet metal up to 14 gauge.

3. *Hardened Self-tapping Sheet Metal Screws*—*Type "Z"* . . . are turned into drilled, molded, punched or pierced holes with a screwdriver. Used for making fastenings to sheet metal up to 10 gauge; and to die castings, Bakelite, slate, ebony asbestos, etc.

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exceed 10 weeks in any 12 consecutive months. When an employe is working part time and receiving less than 50 per cent of his average full time wage he may be eligible for payments amounting to the difference between the amount he is receiving as wages and the maximum he might be entitled to under the unemployment plan.

Should an unemployment emergency arise at any particular works, when payments from the fund are 100 per cent or more of the average normal receipts, then all employes of this works, whether participants in the plan or not, and including the highest officers of the company connected with the particular works, will be called upon to contribute approximately one per cent of weekly or monthly earnings. Also, in such an emergency, all the general and district commercial men, general manufacturing, engineering and administrative employes of the company at all works and offices in the United States not on a particular works payroll shall contribute their proportion to the fund. This proportion shall be determined by the ratio of the average earnings of the contributing employes of the particular works to the total payroll of the eligible employes of all works of the company. For example, if the Schenectady works should adopt the plan and the average earnings of its contributing employes should be 20 per cent of the total payroll of the eligible employes of all works, then 20 per cent of one per cent shall be contributed to the fund. Thus an office employe receiving $2,000 per year would be called upon to contribute $4 per year. The General Electric Company will contribute dollar for dollar to all such monies added to the fund. After the emergency is over, normal payments to the fund by participants will be renewed.

Under the plan for stabilizing employment, regulations set down by Mr. Swope follow:

When Business Is Increasing:

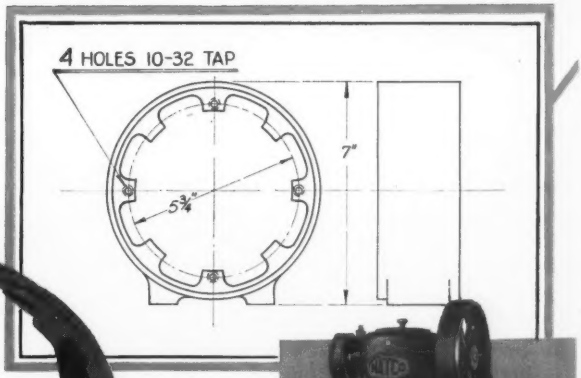
1. Increase the working force by adding employes as slowly as possible.
2. Increase the number in especially busy departments by transfers from other departments.
3. Resort to overtime in particular departments and generally before increasing the working force.
4. Postpone plant renewal and maintenance work as much as possible, employing the men on regular production.

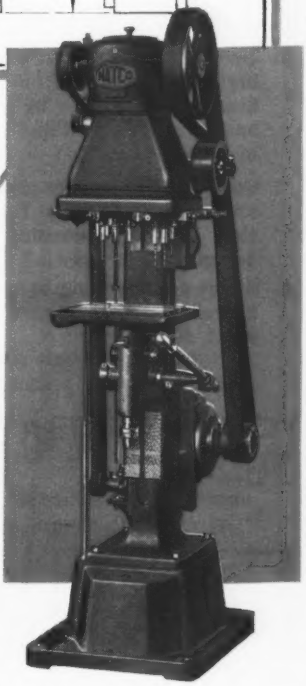
When Work Begins To Fall Off:

1. Cease hiring at once.
2. Cut out all possible overtime and bring departments down to the normal week.
3. Transfer people from slack to busier departments.
4. Stimulate the Sales Department to secure co-operation from customers and get business for future delivery.
5. Build standard apparatus for stock up to *months' shipment, based on average of last three years' sales, adjusted to expectation of next two years.
6. See that stocks at all factory and district warehouses are brought up to this maximum.
7. Use men on maintenance and repair work, bringing the plant and equipment up to a high standard.
8. Cut the normal week as generally and gradually as possible, by departments (down to 50% of the normal week).
9. Proceed with construction of increased plant facilities previously planned, using our own men as far as possible.
10. Drop new employes with less than one year of service—single people with no dependents and who are most easily spared first—always with not less than one week's notice.
11. In accordance with our custom

(*Continued on page* 50)

* Varies.





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RICHMOND, INDIANA, U. S. A.

Modern Tooling Practice, IV

By FRANK W. CURTIS

IN designing drill jigs, there are many points that should be taken into consideration, because much depends upon the efficiency of the finished jig. Here are some suggestions which, if adopted as rules by the jig designer, will save time and aid in the production of a better tool:

1. Never be in too great a hurry when laying out a jig. Remember that many parts are to be made in it, and a slight mistake may result in a serious loss.
2. Consult the shop executives often and be sure to have full information before proceeding with the design.
3. Every small saving in time counts; therefore, try to create an efficient design.
4. Make the layout as simple as possible without sacrificing efficiency. Fancy curves and unnecessary contours increase tool costs.

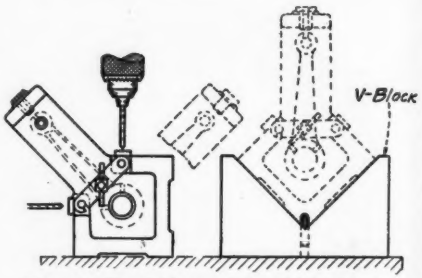

Fig. 22—Simple form of jig which permits drilling from three directions.

5. In designing a jig similar to one already in use, do not make an exact copy of the previous design. Analyze the operation and attempt to create a better design.
6. Always bear in mind that lightness and rigidity are two essential requirements in drill-jig design.
7. Round all corners as a safeguard to the operator.
8. Try to make the jig fool-proof; that is, arrange the locating points so that the workpiece can be loaded only in the correct manner.
9. Before starting the design, determine the proper locating points and clamping surfaces.

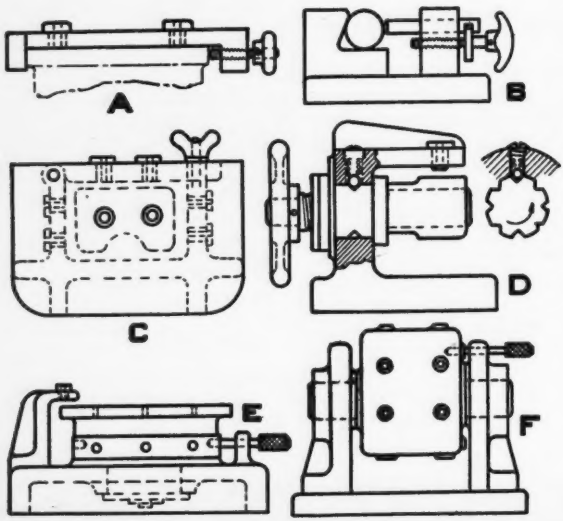

Fig. 21—Various types of drilling jigs.

(*Continued on page* 38.)

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You'll marvel at the accuracy with which it works.
You'll revel in the fine Swiss workmanship.
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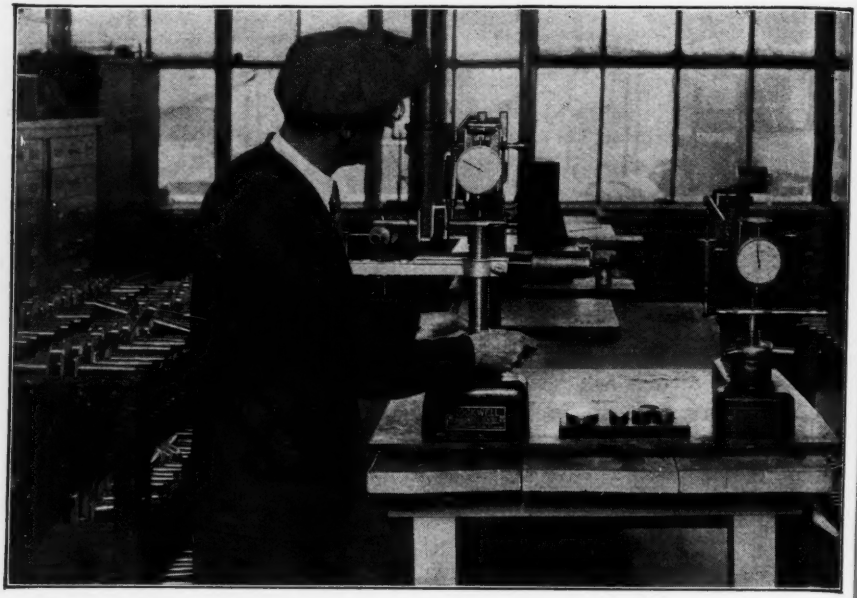

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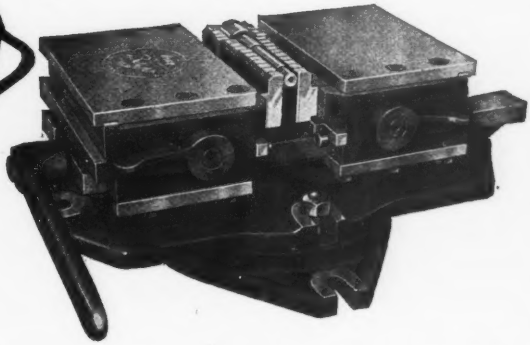

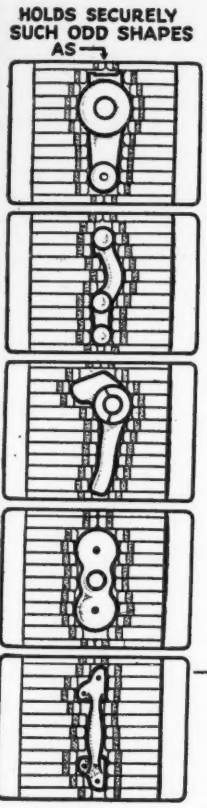

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Modern Tooling Practice

(*Continued from page 34.*)

10. Have all locating points in view of the operator, if possible. Remember that it is hard to clean these surfaces when they are hidden from view.

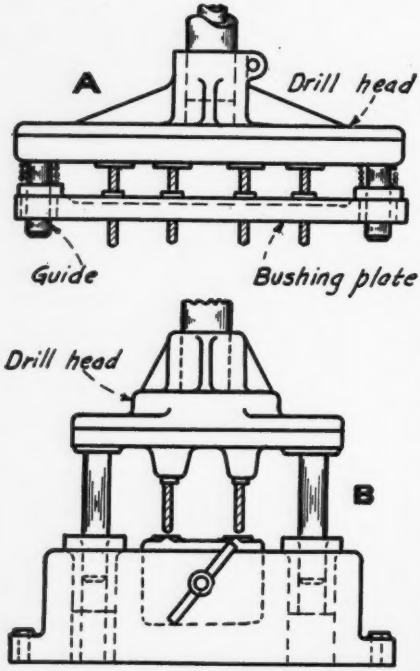

Fig. 23—Types of multiple spindle drill heads.

11. Try to make all units, such as clamps, an integral part of the jig. Loose units are very apt to become lost.
12. Arrange the clamps so that the workpiece will not be sprung.
13. Chip clearance is essential in any drill jig. Be sure to provide ample room for chips.
14. Consider the cutting lubricant and be certain that it can reach the points of the tools properly and in sufficient quantity.
15. Check the drawing thoroughly, especially from the standpoint of manufacture, to determine whether or not the jig can be constructed with ease. Also, be sure that the jig will fit into the machine.

Types of Jigs

Jig designs include a variety of types, but they are all intended for the same purpose — to drill holes within given specifications accurately and rapidly. Perhaps the simplest type of drilling unit is the plate jig illustrated at **A**, in Fig. 21. A jig of this type usually fits over the workpiece and is clamped by means of screws or a hook-bolt. At **B** is shown an open-type jig, so-called because there is no leaf or body enclosure; thus the workpiece is clearly visible when it is clamped in place. At **C** is shown a "roll-over" jig, used to drill workpieces which require drilling from two or more surfaces. The body of the jig is made with round corners of generous proportions, so that the jig can be turned from one side to the other with ease. The closed-type jig is of similar design with the exception that no provisions are made for turning. At **D** is shown an index jig of the horizontal type. In use, the

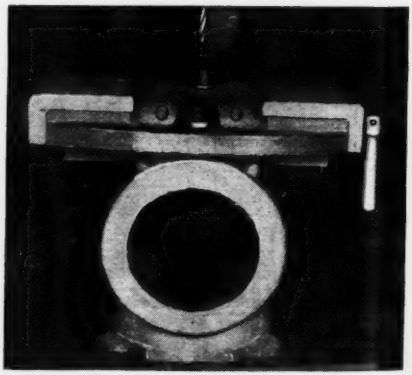

Fig. 24—Plate-type jig, held in place on work by clamp at right side.

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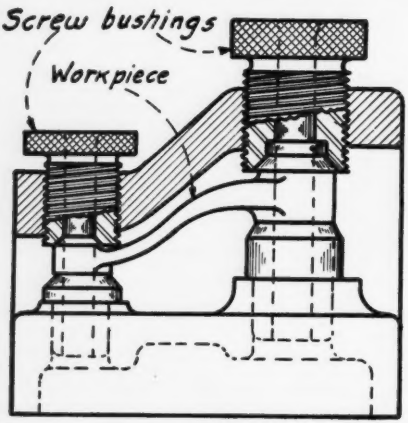

Fig. 25—Screw-type bushings, used where accuracy is not essential.

work is rotated from one location to the other, so that several holes can be drilled from various angles at equidistant points on the periphery. Another indexing jig is shown at **E**, although this design is of the vertical type. The workpiece in this case can also be rotated to obtain a required number of spacings. At **F** is shown a trunnion drill jig, so termed because it is mounted on two bearings and can be rotated and locked, so that holes can be drilled into the workpiece from the several sides.

Another form of drill jig, the design of which permits drilling from three directions, is shown in Fig. 22. The operation could be handled in an indexing jig, although it would be necessary to move the work from one spindle to another due to the various heights to be drilled. Then again the production might not warrant an expensive indexing unit, in which case a design such as that shown will be found satisfactory. The workpiece is a small connecting rod in which two angular oil holes are to be drilled at the large bearing, and a setscrew hole at the pin bearing. After the angular holes have been drilled, the jig is located in a V-block so that the workpiece is presented in an upright position.

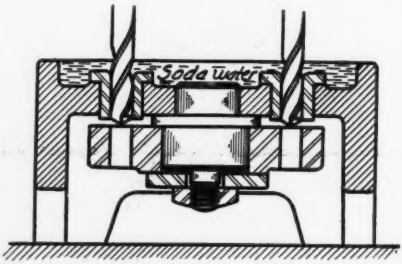

Fig. 27—Jig with built-in reservoir for coolant.

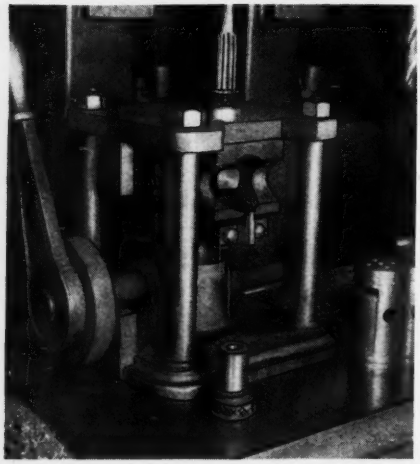

Fig. 26—Cam-type jig, adapted for drilling and reaming wrist pin hole in piston.

In drilling a number of holes in a workpiece, it is usually economical to use a multiple spindle head, providing, of course, that the production required is large enough to warrant the expenditure. Multiple heads are divided into two classes. One type of head merely has the spindles arranged at the correct center distances and depends upon bushings located in the jig to align the drills. The other type has a bushing plate attached to it, which, of course, operates as an integral part of the head and thus aligns the drills independently of the

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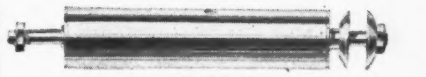

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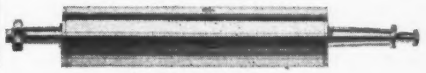

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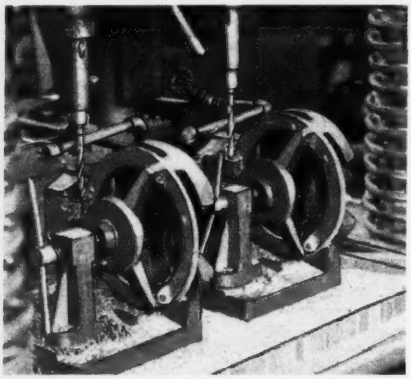

Fig. 28—With two jigs, the operator loads one while the other is in operation.

jig. Such an arrangement is illustrated at **A** in Fig. 23. As will be seen, the jig plate is attached to the drill head so that it rests on the work when the spindle of the machine is lowered. It is also possible to use a multiple head without bushings in drilling parts where great accuracy is not required, such a design being shown at **B**. Two guide pins are attached to the multiple head, which in turn fit into guide bushings located in the jig.

In Fig. 24 is shown a plate-type jig used in connection with the drilling of two holes in a cast-iron body. The jig fits over the flange of the work, and is held in place by the clamp shown at the right side. In this case the bottom face of the work has been milled in a previous operation and the jig, therefore, is aligned from this surface. Jigs of this type will be found suitable for the drilling of a few small holes in large parts, for which an expensive closed-type jig would otherwise be required.

Screw-type bushing jigs are used in cases where extreme accuracy is not essential, such a jig being illustrated in Fig. 25. Here the work is held by two bushings, thus eliminating any auxiliary clamps. When bushings of this type are used, the angular contacting surface should be relieved at three or four points to facilitate chip removal.

Cam-type jigs are coming into extensive use and have a rather broad field. Jigs of this type are now available in the market. The design of the jig makes it adaptable to the usual type of job, the only construction required consisting in providing clamping surfaces and installing the necessary bushings. An example of a cam-type jig, adapted for drilling and reaming the wrist-pin hole in a small

(*Continued on page* 46.)

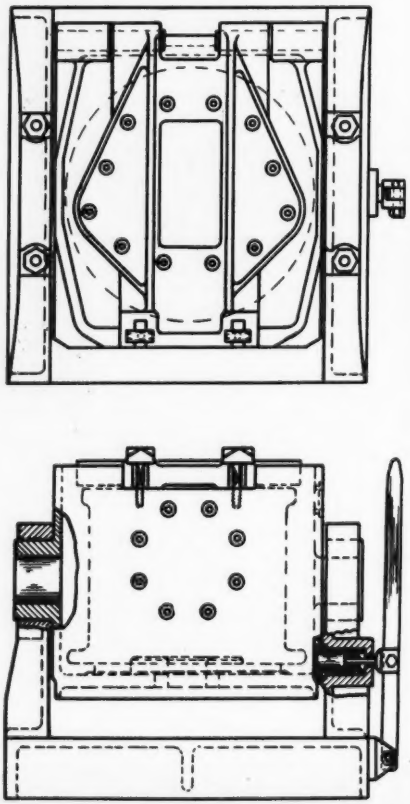

Fig. 29—Trunnion jig which permits drilling from four directions.

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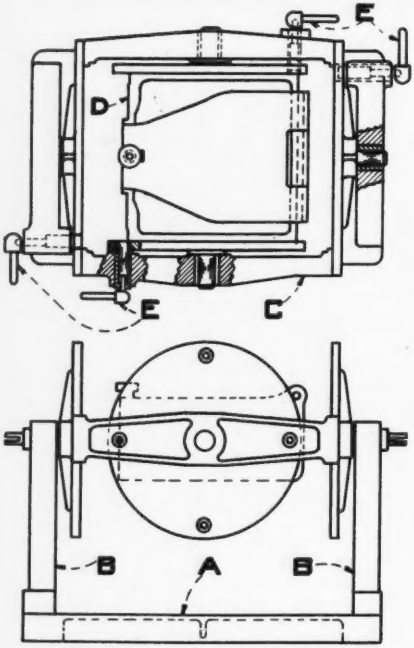


Fig. 30—Double-type trunnion jig.

Modern Tooling Practice

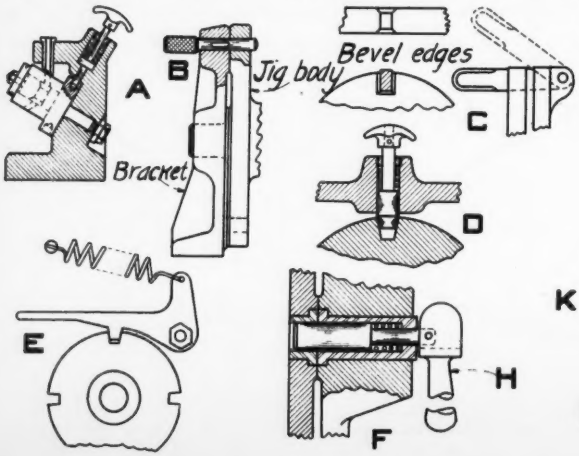
(*Continued from page 42.*)

piston, is illustrated in Fig. 26. The work is placed horizontally in a locating block and is held in place by a perpendicular clamp operated by the handle at the left-hand side of the jig.

As mentioned previously, drill lubrication should be considered thoroughly, because lack of compound at the cutting point of the drill will cause the edges to dull rapidly, due to the excessive heat generated during drilling. A jig embodying a reservoir for the cutting compound is illustrated in Fig. 27. The top surface of the jig body provides a chamber for the compound with the level of the fluid above the tops of the bushing heads. The compound passes through the flutes of the drills and thus reaches the cutting lips.

Index and Trunnion Jigs

In some cases it will be found economical to provide two jigs for a given operation, so that the operator can be loading one while the drill is feeding through the other. An example of this arrangement is shown in Fig. 28, consisting of a pair of indexing jigs for the drilling of three equally spaced holes in a clutch ring. The holes are drilled through lugs equally spaced on the ring body, and the work is held by a spider-type clamp having three projections that strike these lugs. The holes, which are ⅜ in. diameter, are drilled at the rate of 14 pieces in nine hours. With one jig,



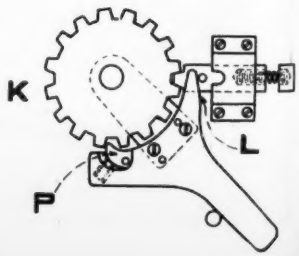


Fig. 31—Various types of locks used in indexing trunnion jigs.

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but half of this production could be obtained.

In Fig. 29 is illustrated a trunnion jig of the single type, which permits the drilling of a large casting from four surfaces. The jig shown is of a rather large type, in which the bearings are made integral with the jig body. The indexing and locking pin is located at the right-hand side of the fixture. The jig body is made with a hinge of the cast type and is mounted on two hinged pins, due to its large size. There are also two leaf locks provided to insure proper alignment of the leaf.

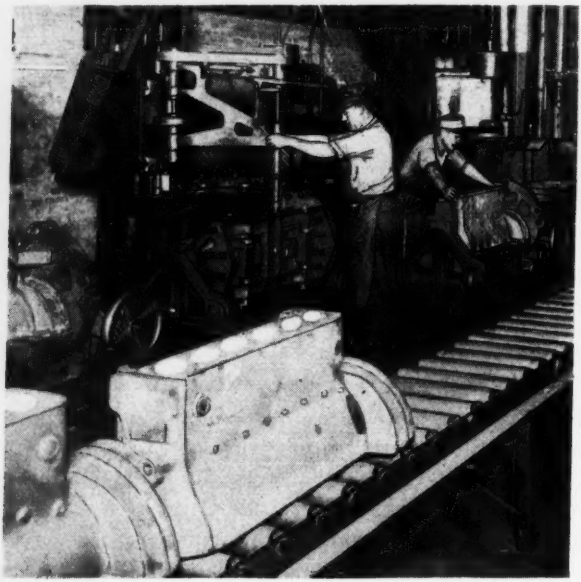
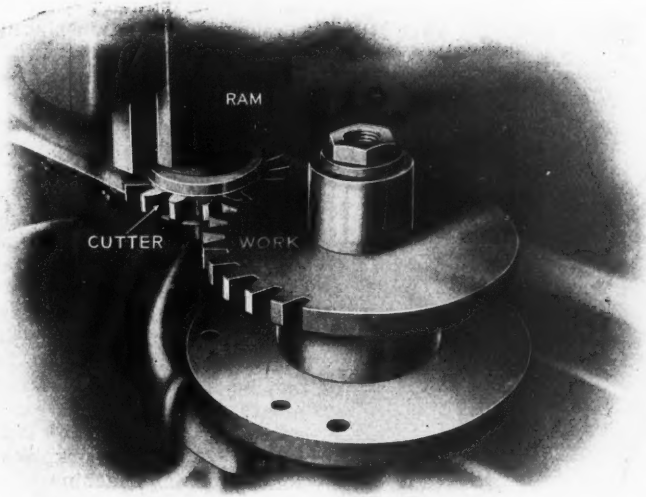


Fig. 32—Trunnion Jigs In Use For Machining Cylinders.

A trunnion jig of the double type is illustrated in Fig. 30. The principle of this jig is somewhat similar to the single type, although there are two sets of trunnions and the work can be drilled from six sides. The various members comprise the base **A**, brackets **B**, the cradles **C**, the jig body **D**, and the indexing and locking devices **E**. As will be seen, there are two sets of locking plugs used, on account of the size of the jig, to insure proper alignment.

Various types of locks are available for indexing trunnion jigs, several of which are illustrated in Fig. 31. At **A** is shown a straight plug type arranged with a spring and knob. The plug fits into holes spaced around a flange made integral with the rotating member. The plainest type of locating pin is the plug shown at **B**. At **C** is shown the hinged-bar type locator which consists of a bar fastened to the bracket by means of a pin which, in turn, is fitted into slots cut into the flange of the jig body. At **D** is shown a vertical-plug type, having a spring-operated plug mounted in the stationary member of the jig, which in turn fits into holes machined into the rotating member. At **E** is the lever-type locator, which is hand-operated and is quite effective for the average jig of medium size. At **F** is the cam-type plunger, which is withdrawn by swinging the handle **H** to the opposite position. In this example the plunger is aligned by hardened bushings in order to insure accuracy and resistance to wear.

Another form of indexing plunger is shown at **K**. This device is semi-automatic in operation, locking and indexing work by one movement of the handle. When the lever is moved upward, the cam face **L** strikes a pin located in the plunger, which causes



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the plunger to withdraw. During this motion the pawl P moves to the next indexing notch, so that when the handle is returned, the pawl causes the indexing plate to revolve with it. The plunger is likewise released and also enters the next notch.

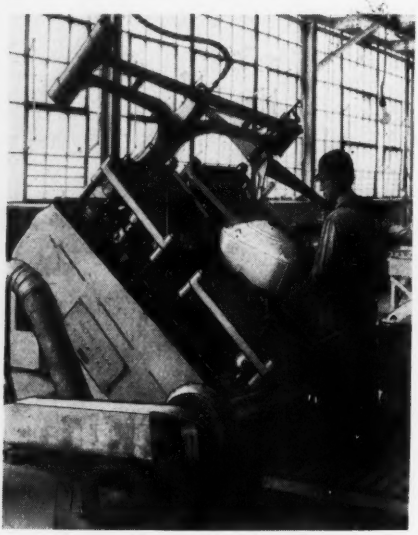

Fig. 33—This special machine drills 43 holes in five different planes.

An example of the use of large trunnion jigs is shown in Fig. 32. The work in process is a cylinder block requiring the drilling and tapping of several holes from various faces. The operation requires the use of several machines and the jigs, therefore, are mounted on rollers which travel on a track, so that a loaded jig can be passed from one machine to another. Five jigs are used, so that there will be no lost time in loading and unloading. As soon as a jig has reached the end of the line, it is transferred to a small auxiliary track, mounted on wheels, on which it is passed in a crosswise direction. The cylinder block is removed and placed on the conveyor, then the jig is wheeled back on a return track to the original starting point, where it is reloaded and again placed in service on the operating track.

Sometimes the nature of the workpiece is such that a special machine is required for drilling, in which case the matter of production presents an entirely different tooling problem. For example, in drilling parts that require a large number of holes at different angles, where a large production is desired, it will often pay to investigate the possibilities of a special drilling machine. It may be found that the saving in time will warrant the expenditure, which in some cases can be saved in from six to twelve months. An excellent example of a special drilling machine is illustrated in Fig. 33. The workpiece is a tub for a washing machine that requires the drilling of 43 holes in five different planes. The work is placed into the machine by the operator and is located by a swinging arm pivoted at the rear of the machine. The clamping is done pneumatically and the various drilling spindles are engaged by the operation of a single lever.

General Electric Fund Plan

(*Continued from page* 32)

established for some time, employes should be told whether it is a temporary lay-off due to lack of work, or permanent lay-off, and in every instance of permanent lay-off, the usual compensation, if any, should be paid, depending upon character of work, age and length of service.

B. & S. Small Tools Booklet

The new Small Tools Booklet which has been published by The Brown & Sharpe Manfg. Co., Providence, R. I., is now ready for distribution. This booklet contains detailed information concerning products which have been added to the Brown & Sharpe line during recent months, including machinists' tools of various kinds, cutters, screw machine tools and arbors.

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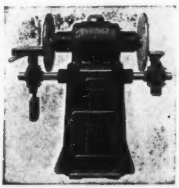
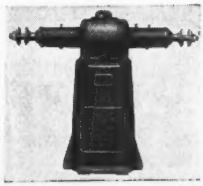
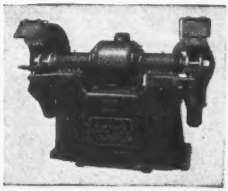

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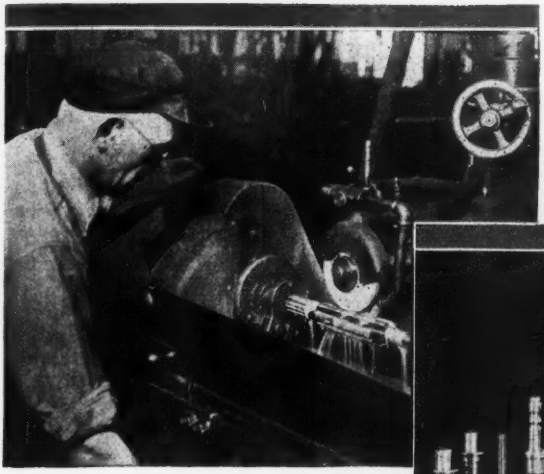

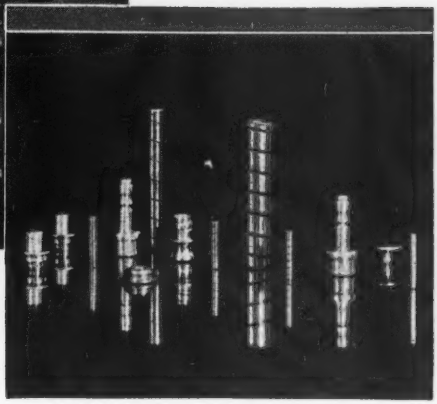

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Exhibit of Mechanical Movements at the Newark Museum, Newark, N. J.

THESE illustrations show sections of the exhibition of mechanical movements which are now on display at the Newark Museum, Newark, N. J. The exhibit comprises 200 electrically-operated models which demonstrate the mechanical principles upon which modern industry is founded, and includes applications of these principles to a number of machines, both domestic and industrial.

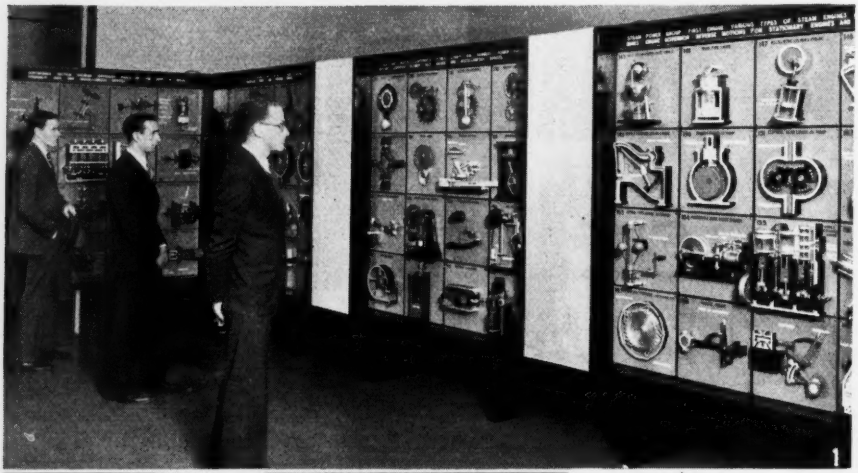


Fig. 1—One corner of the display, showing the arrangement of the exhibits on the panels. The visitor can set the models in motion by pressing a button which controls a motor at the back of the panel.

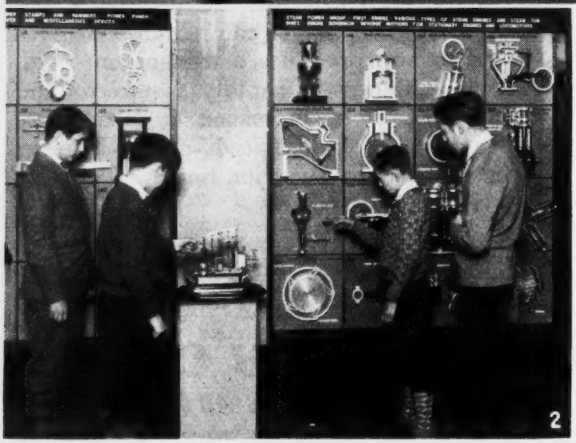


Fig. 2—Students of a manual training class studying the various kinds and types of mechanical movements. The action of the steam engine, internal combustion engine, pump, time-piece, governor, turbine, valve mechanism, and other kinds of mechanical units can be observed in action here.

THE models are displayed on ten large boards, each containing twelve panels, and can be set in motion by pressing a button on a railing which runs the length of the exhibit. The principles upon which many familiar household devices and other complex mechanism operate are made comprehensible to the average citizen who can thus gain practical information about the "works" of the steam engine, automobile, sewing machine, pipeless furnace, water pump, and many other machines in daily use. For the technologist and inventor there are said to be innumerable suggestions for saving time and money among the 200 standard mechanical movements shown.

The student—of whatever age—will find here a complete laboratory of mechanics and will be able to see in actual operation, many of the types of mechanisms with which he has heretofore been acquainted only through text and picture. A visit to this exhibit will comprise a valuable addition to engineering training.

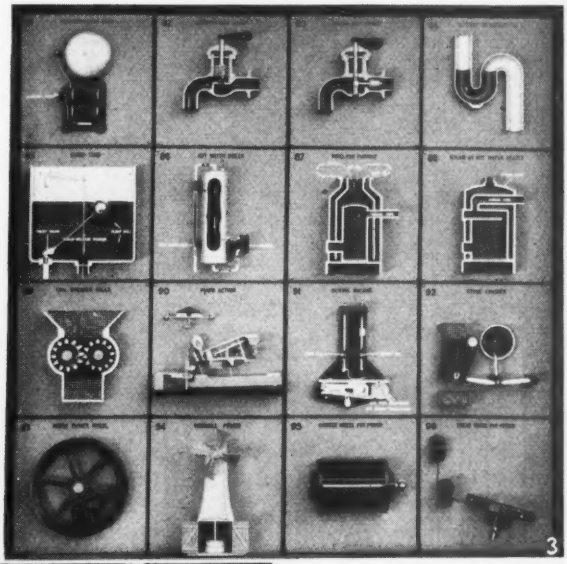


Fig. 3—A panel showing the operation of the mechanism of various kinds of household devices and different kinds of power units.

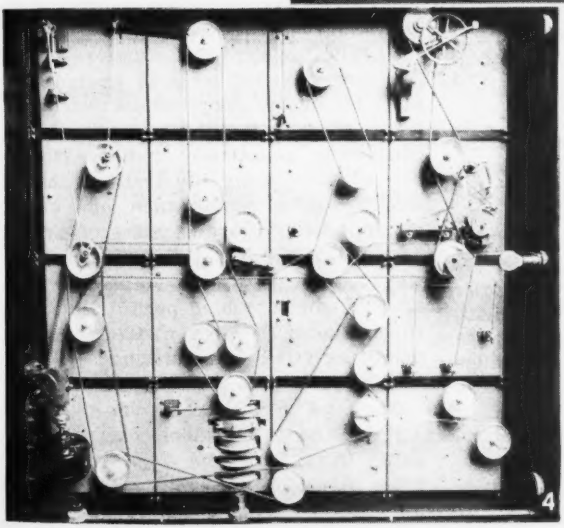


Fig. 4—Back of panel No. 1. Single and double grooved pulleys are essential parts of the mechanical models and serve to illustrate the action of such pulleys for industrial uses. The pulleys are located on the backs of the panel sections, and serve to transmit power from the motors to the models.

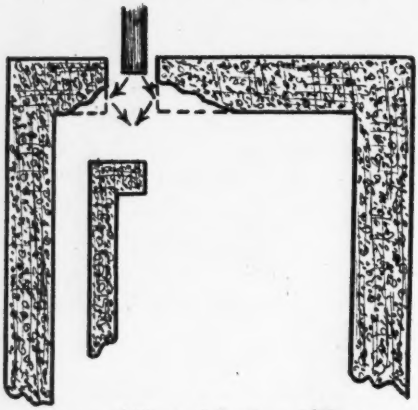
Ideas From Readers

This department is a clearing house for ideas. If there is a "kink" or short-cut in use in your shop, send in a description of it. We will pay $5 for each one published.

A Hint On Furnace Repair

By R. H. KASPER

ON heat-treating furnaces where the nozzles enter from the side, the nozzles are set somewhat in back of the opening in the fire-brick. The



Arrows indicate deflection of flame.

corners of the fire-brick ahead of the nozzles are usually the first to break off, as shown in the illustration, the original shape being shown by the dotted lines. When the furnace starts to act queerly, and a repair is attempted, these corners are usually patched up with refractory cement, following the general outline of the cracked surfaces. This seldom makes any great improvement in the action of the furnace, as the importance of these corners is not generally recognized. When the flame spreads out from the nozzles, it strikes these corners and is deflected to the center, as shown by the arrows. The purpose of this is two-fold; first, when the corners of the firebrick become incandescent, they act as a pilot, igniting the gas as soon as it issues from the nozzle, and, second, it keeps the flame as small as possible until it reaches the combustion chamber, where it is free to spread out. A temporary repair may be made by building up these corners with refractory cement, but lasting results will only be obtained when the firebrick is replaced. A nozzle which is kept behind the corners of the firebrick will have a longer life, as it is protected from the direct heat of the furnace.

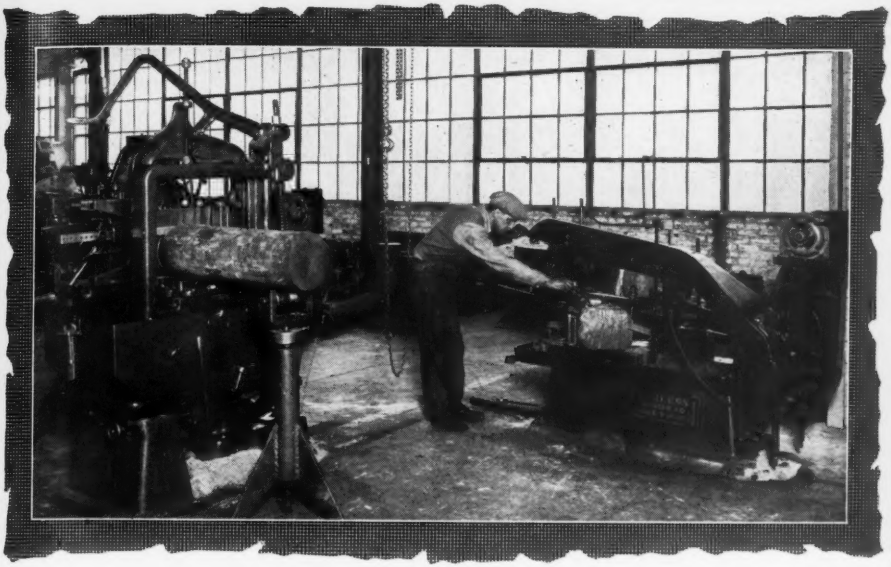
Locomotive Tire Wagon

By H. H. HENSON

A TIRE wagon or carrier is a very useful piece of equipment and in every shop where such a piece of equipment is in use it is considered practically indispensable. The accompanying illustrations show a tire wagon with which one man can handle the largest sizes of tires. The most important feature of the wagon consists in the eight-inch diameter wheels, which permit the tire to be placed in close quarters when mounting tires on driving wheels where the valve gearing interferes.

The tire is picked up on the adjustable hook **A** which can be located in any of the 1¼-in. square holes **B** in the upright member **D**.

(*Continued on page* 61)



Making Oil Well Bits

Simonds "Red Streak" High Speed Steel Hack Saw Blades—the blades with the red back edge—are used in the Los Angeles, California plant of the Universal Engineering Company in the manufacture of their high quality Zublin Rotary Drilling Bits. The power machine on the left has just cut a round bar of steel from which thrust pins will be made. The saw on the right is cutting a billet of steel from which a shank will be made. Famous Hack Saws used on Famous Products.

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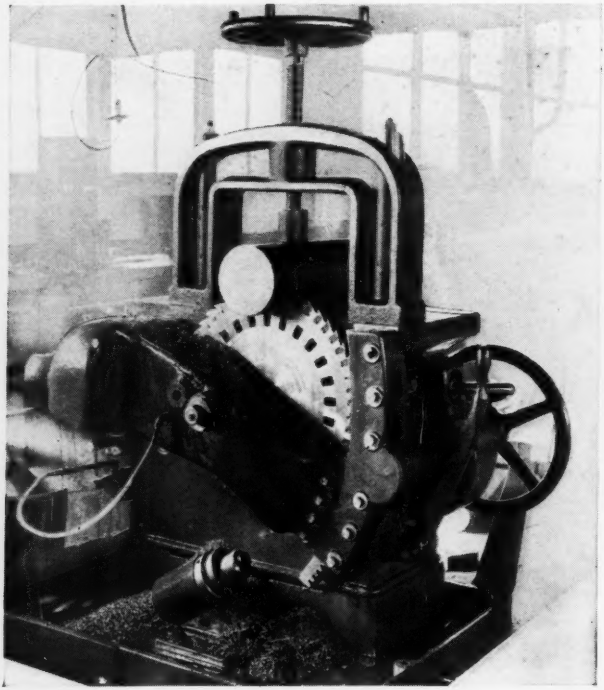

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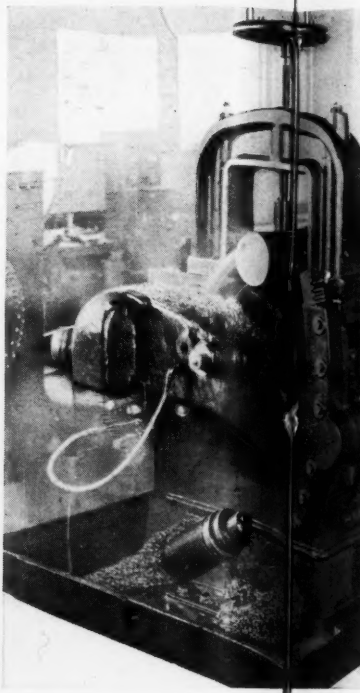

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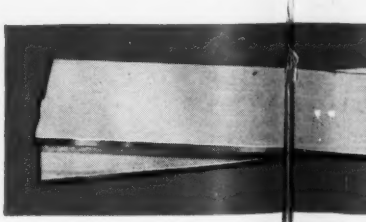

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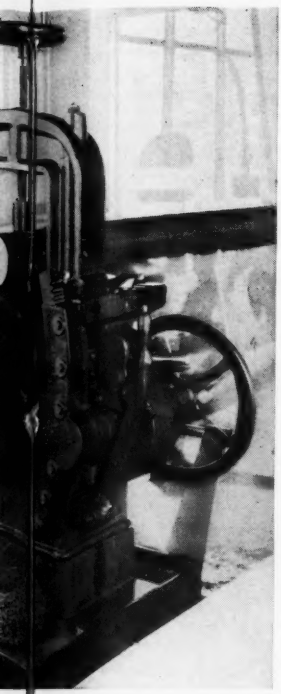

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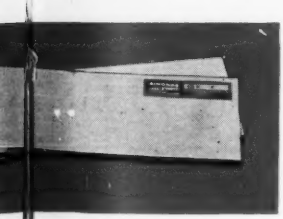

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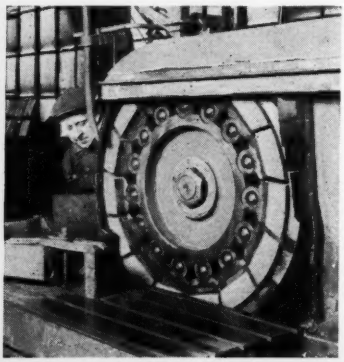

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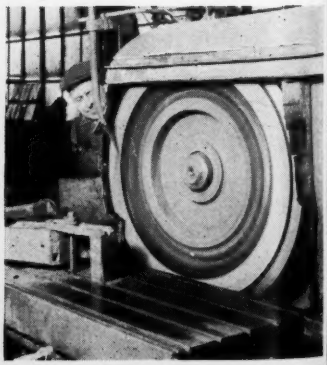
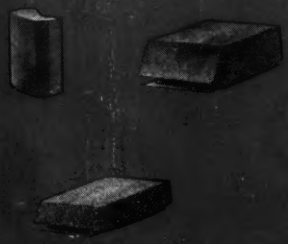


GRINDING WHEELS



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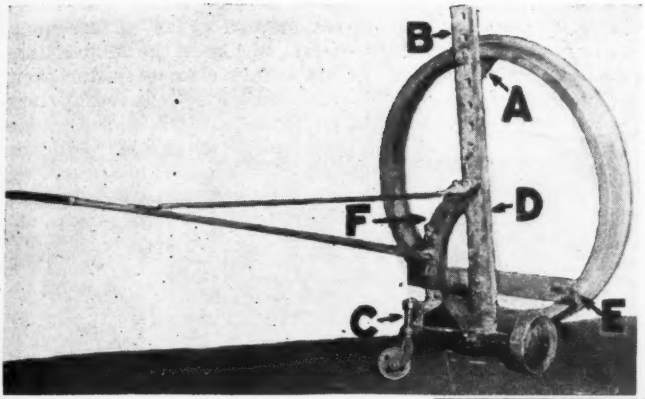
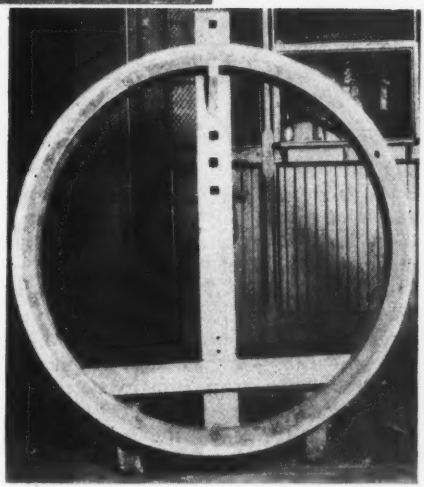


(Left)—Locomotive Tire Wagon with Tire in Position for Moving. (Below)—View of Wagon From Rear Showing How Tire is Supported.

Ideas From Readers

(*Continued from page 56.*)

The holes are five inches apart and the hook can easily be moved by hand. The upright member **D** is of 1¼ x 6-in. bar steel. The small wheel on the swivel **C** makes it possible to rest the tire in a vertical position without the necessity of holding the tongue of the wagon. The tire is supported by the cross member **E**, which is bolted in place about two inches above the wheels. The tongue, which is forged steel, is bolted to the member designated as **F**. Two laborers can handle tires of the largest size from the machine shop to the round house, and the wagon will also be found useful where crane facilities are lacking.



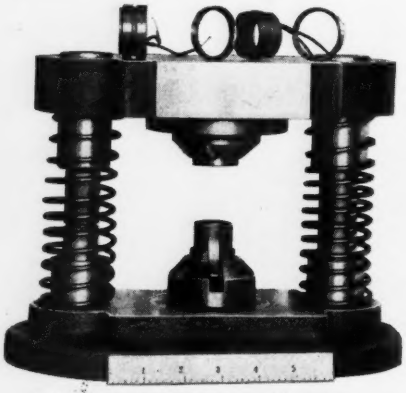
Standard Die Set Converted To Assembly Fixture

By PAUL A. BARD

BECAUSE the use of an assembly fixture may so often minimize rehandling, increase the rate of output very materially and eliminate so many common causes of mistakes, it is the general opinion that money spent on assembly fixtures—where production justifies—is a good investment. The basis for this opinion is, of course, that if the money is spent on the fixture, from that time on mistakes and expenses can be obviated.

This reasoning is sound, of course, provided that the quantity is sufficiently great to enable the savings in production to more than counterbalance the higher first cost of the assembly fixture. The illustration shows a fixture that is particularly interesting and suggestive, because of its sim-

plicity and low first cost. Assembly fixtures are usually looked upon as something special, and in consequence call for considerable designing and individual attention on the part of the



Die Set In Use As Assembly Fixture

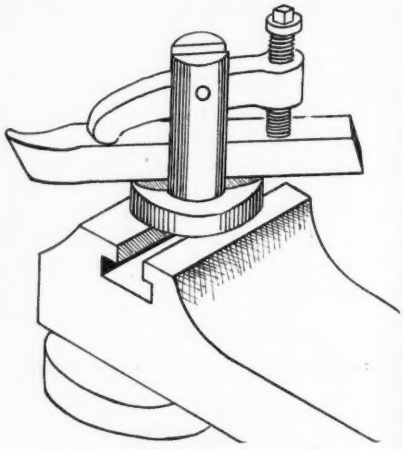
tool builder. Most assembly fixtures are looked upon as "special." The fixture shown is merely a standard Danly die set, adopted "as is" with only one slight modification.

The die set shown is used by a large electrical manufacturing company for assembling two copper rings upon a fiber bushing, which is done in an arbor press. These parts, unassembled and assembled, are shown on the top of the fixture. This is a standard M-1C set, using standard extra-long bushings in the punch holder, together with Danly pressure-pad springs. The only difference between this assembly fixture and the standard Danly die set is that stop collars have been located on the guide posts to stop the punch holder, which is the removable element of the assembly fixture, as it comes down in the arbor press. By using a standard die set in this way, considerable saving is made in the design. The only work required in the present instance was that necessary to mount the two elements in the punch and die holder (which would be necessary, of course, were the die set being used as a die set instead of as an assembly fixture) and to locate the stop collars on the stationary element. Moreover, these standard die sets with their hardened, ground and lapped guide posts and bushings, together with the accurately-ground working surfaces, provide a precision that in the majority of instances would never be obtained in an assembly fixture.

A Rigid Tool Post

By CHAS. H. WILLEY

HAVING occasion to make a new tool post for one of the heavy duty lathes, the writer conceived the idea of making a tool post that would afford a better grip on the tool than could be obtained by the usual type of post. Accordingly, a post was made and milled out to take a double-end clamp, which was pinned in position in the post as shown in the illustra-



Tool Post With Double-End Clamp

tion. Pressure is applied by means of a screw in one end of the clamp, the pressure thus obtained being applied at either end of the tool. Not only is greater pressure obtained by this de-

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sign, but the pressure is applied in such a manner that the tool is prevented from swinging under pressure of the cut.

Abuse of the Diamond Emery Wheel Dresser

By R. H. KASPER

THE use of the diamond emery wheel dresser is essential when grinding wheels are required to be perfectly true or of special shape. If used excessively, however, the diamond may result in increased grinding costs or damaged work, as the following instance indicates. In the shop where the writer is employed, trouble was experienced with the overheating of dies in grinding. An attempt was made to eliminate the difficulty by decreasing the depth of cut until a maximum of .003 in. per cut was reached, without improvement in the results. Upon investigation it was found that the operator, in order to insure that the wheel would be perfectly true at all times, was using the diamond dresser after each cut. The suggestion was made that the diamond be used only when the wheel produced chatter marks on the surface of the work or just before the final cut was taken, a dresser of the spur wheel type being used to dress the wheel on all but the final cut. Though the finish produced was not quite as smooth, a depth of cut of .025 in. became possible without perceptible heating of the work, incidentally decreasing the grinding time proportionately. A wheel that is dressed with a diamond dresser does not cut as freely as when dressed with a spur wheel dresser, due to the fact that the spur wheels dig out the dulled abrasive grains more readily. Therefore, the spur wheel dresser should be

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ADJUSTABLE REAMERS

The makers of each Wetmore Reamer take pride in its perfection. They are guided by the thought that each reamer, when completed, will be used by the kind of men who take pride in *their* work. That is one of the reasons why Wetmore, for many years, has been known throughout industry as "The Better Reamer".

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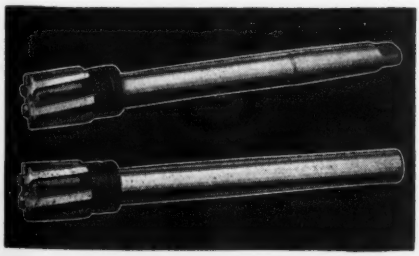

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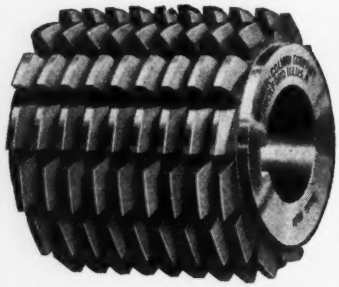

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THESE Small Tools are built for long hours of steady use... to stand the battering of a heavy feed and emerge triumphant... to hew steadily to the limit line beneath a chattering mountain of chips... Quality to the core... strength and sturdiness ever dependable.

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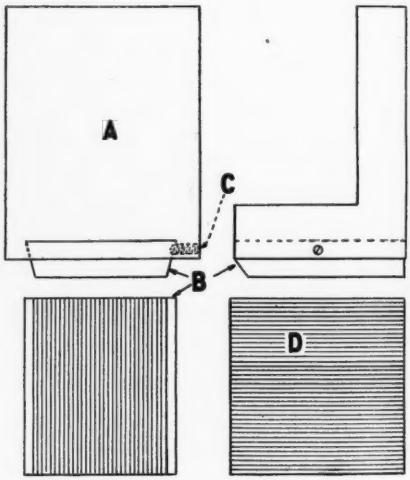
used to dress the wheel up until the final cut is to be taken, the diamond being used to give the wheel the necessary finish for the final cuts. This rule applies on all plain surface or cylindrical grinding; on special shapes the spur wheel cannot be used.

Knurling Round Stock In The Shaper

By CHARLES R. WHITEHOUSE

THE tool shown in the illustration was used successfully to knurl a large quantity of short sections of round stock. The holder **A** was used



Dies for Knurling Round Stock in the Shaper.

in place of the swivel block on the shaper, but was locked in position while in use. The holder is made with a dove-tail slot for the die **B**, which is held in place by the screw **C**. The die **D** is locked in the shaper vise. Teeth are milled in the dies **B** and **D** according to the knurl desired, the lower die being milled at an angle op-

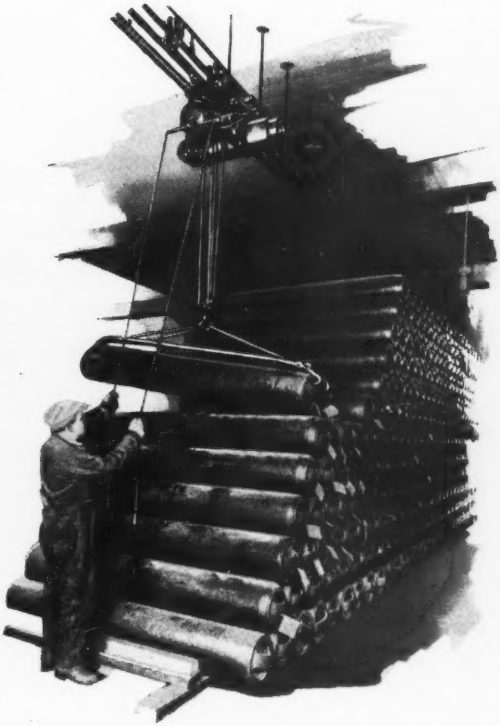
(*Continued on page* 102.)

STACK IN *Higher Piles* *with* SHEPARD'S CLOSE CLEARANCE HOIST

THERE'S no lost storage space when this hoist is installed. It fairly hugs the track, providing a minimum of clearance between load hook and trolley wheels. And this without sacrifice of sound, performance-proved design.

"Balanced" drive, automatic oil bath lubrication, complete enclosure in units each separately accessible, permanent alignment and precision control are features of Shepard design that are contributing to low-cost load handling throughout industry. Unit construction assures unvarying quality, perfect duplication of performance.

On monorail track, on a jib or a single I-beam crane, if head room must be saved, insist on a Shepard Close Clearance Hoist. Many profit producing applications are described in "Illustrated Economies." Write for a copy.



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Over the Editor's Desk

Faith

SHARES of New York Central Railway stock totalling 118,032 shares would be required to fill the subscriptions of employees of that railroad who availed themselves of the privilege, extended to those two years or longer in the service of the company, of subscribing to stock in the company at $130 a share. Requests for stock were received from 31,997 employees, and the total amount involved at the price indicated reached $15,344,160.

This should serve a fair indication of the faith and confidence with which its leaders are regarded by American industry. It is true that we haven't ironed all the bugs out of our industrial machinery; we have a few problems on our hands that will have to be disposed of before we achieve the ideal, but it is also true that those who are responsible for our industrial destinies are losing no time in taking steps to eradicate evils which, a few years ago, were considered necessary. Read the article on page 30.

Ford Wages in Foreign Plants

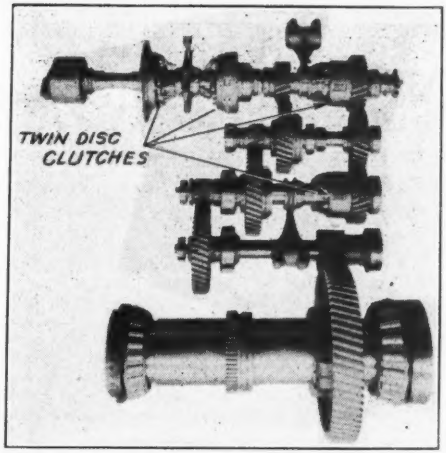
ACCORDING to an interview in "Nation's Business," Henry Ford is convinced that the best solution to the tariff problem is the elimination of the necessity for a tariff by having foreign labor paid an amount commensurate with American wages. In the Ford plant at Cork, Ireland, a minimum wage of seven dollars has been put into effect, giving an American scale of wages to approximately 4,000 workmen. In Ford's new plant in England, 30,000 men will be employed at not less than a pound ($4.83) a day. Similar wages are being paid in Ford plants throughout the world. Mr. Ford's theory is that mass production and high wages in all countries will place costs and selling prices on an even footing, with the result that tariff barriers will become unnecessary. We hope he is right; tariffs seem to worry everybody, unbutton a lot of oratory, and suit nobody. One thing is certain; the more Henry Ford can do to raise the scale of wages in other countries, the more he is doing for the American workman.

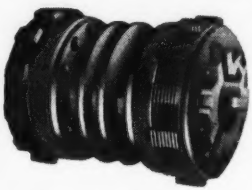
Migration

Last year 1,876,000 persons left the farm for the city. There was a backwash, from city to farm, of 1,257,000 persons, therefore the net migration from farm to city last year was 619,000 persons. The year before it was about the same. On January 1, 1930, our farm population was approximately 27,222,000; twenty years ago it was 32,077,000. What's the answer?

Just 5%

ALL you need is 5 per cent. H. D. Shute, vice president of the Westinghouse Electric & Manufacturing Company, says that the difference between bad times and good times is only about 5 to 10 per cent on the total volume of business. Often the margin between success and failure is just as slender a that. And this statement applies to individuals as well as to organizations. Many a man just misses being in the successful class by just that 5 per cent. If he could make himself 5 per cent faster, more efficient, more inventive, and more accurate, he would be over the top instead of being just on the ragged edge of failure.





New, compact Model C.C. machine tool clutch

PARTS STATIONS

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Chicago—Motive Parts Co. of America, Inc., 2419 Indiana Ave.
Detroit—Whitney Bros., 6464 Epworth Blvd.
Fort Worth, Tex.—Fort Worth Wheel & Rim Co., 312 Throckmorton St.
Houston, Tex.—Portable Rig Co., Inc.
Knoxville, Tenn.—Automotive Equipment & Supply Co.
Los Angeles—Coast Machinery Corporation, 164 E. Third St.
New York City—John Reiner & Company, Inc., 290 Hudson St.
Philadelphia, Pa.—Maerky Machine Works, 632 Race St.
Pittsburgh, Pa.—A. H. Krigger & Co., Smithfield & Carson Sts., Court 2496.
Richmond, Va.—Standard Parts Corp., 1806 W. Broad St.
St. Louis—Climax-Jones & Quinn, 3124 Locust Blvd.
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NOTHING BETTER COULD BE FOUND

LIVING up to the Potter & Johnston slogan —"Maximum Efficiency Automatic Machine Tools"—implies maximum effiiciency in design, construction and materials used in every part and unit of each machine.

When some other manufacturer's product is used in machines built to Potter & Johnston standards, it means simply that nothing better could be found.

Four Twin Disc Clutches, regular stock models, are engineered into the headstock gearing shown above.

We can now furnish stock clutches, of our compact C. C. Model—suitable for use in machine tools—in 2″, 2 1-2″, 3″, 3 1-2″, 4″, 4 1-2″, 5″, 5 1-2″, 6″, 7″ and 9″ effective diameters, dry plate or oil sprayed, single or duplex. Write for engineering data.

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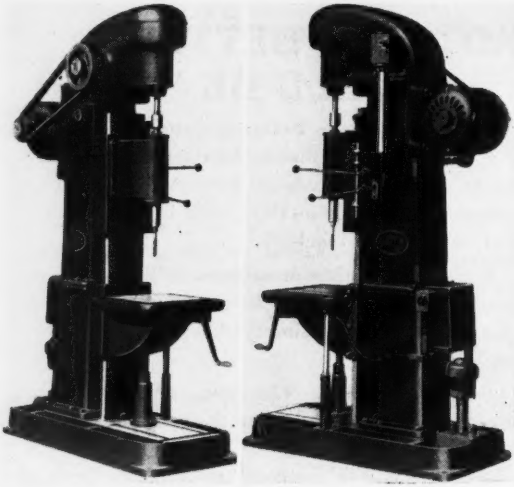
New Shop Equipment

Natco Model B-225H Single Spindle Driller

A single spindle drilling machine of the vertical type, to be known as the Model B-225H, has been placed on the market by The National Automatic Tool Co., Richmond, Ind. The machine is equipped with semi-automatic hydraulic feed, having simplified control which permits instant and positive control of the head, and is arranged with a flat slide especially for the mounting of either single or multiple spindle drill heads. The machine is intended especially to provide means for increasing production where the use of a multiple drill or special equipment is inadvisable.



Natco Model B-225H Single Spindle Driller.

The base of the machine is deep and is ribbed both lengthwise and crosswise to insure rigidity. The working surface is 17½ x 17 in., and is provided with T-slots. Channels on all sides are provided for cutting lubricant. Provision has been made at the rear of the base for mounting a gusher pump, if desired.

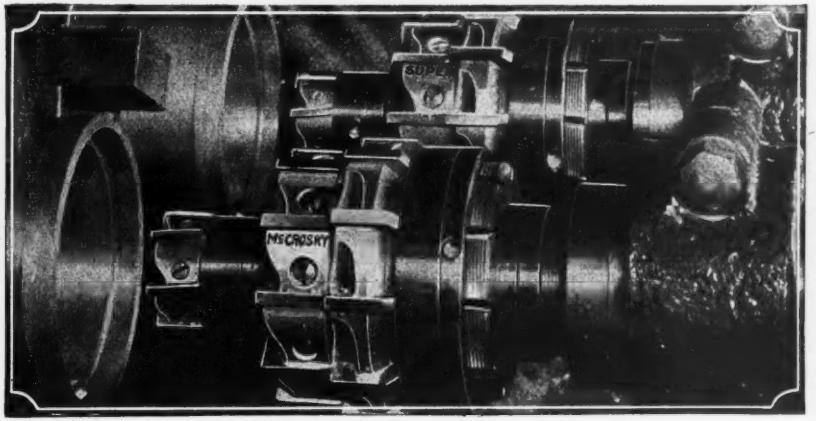
The column is of the box section type, consisting of two sections bolted together. The ways which support the head slide and adjustable table are 10 in. wide with bearing surfaces 2½ in. wide x 1¼ in. deep. Additional counterweights may be added through a large opening in the rear of the column, and an oil reservoir for the hydraulic system is located in the column near the top. Either adjustable knee-type or solid built-in table can be supplied. The knee-type table has a minimum height of 22 in. with a vertical adjustment of 12 in., and is supported by a long bearing on the column as well as by the adjusting screw. The working surface of the table is 16 x 16 in. and is surrounded by a lubricant channel 3 in. wide and approximately 1¾ in. deep. Two T-slots are provided for clamping work.

The built-in table is part of a single casting which forms the lower half of the column, base and table. The working surface of the table is 22 in. high, is 22 in. long by 20 in. wide, and is surrounded by a coolant channel 2½ wide and 1¾ in. deep. A large chip pit is located directly beneath the table.

The head slide is 22 in. long and 14¼ in. wide, and has a maximum travel of 12 in. The distance from the face of the slide to the centerline of the driving shaft is 8.250 inches. Semi-automatic hydraulic feed is provided, with simplified control which permits instant and positive control of the head at all times.

The operating valve trip mechanism is of the "load and fire" type, operated semi-automatically through adjustable dogs. When started, the head travels through a complete cycle of rapid traverse down to the work, feed through the drilling operation, rapid traverse up from the work, and stop at the end of the stroke. The operator starts the cycle by moving a hand lever. A second lever,

Finishing 3 Diameters at Once with McCrosky-SUPER Reamers



REAMING multiple diameters is a natural development of the demand for faster production. The job shown above illustrates how well the McCrosky-SUPER design of adjustable reamer is adapted to handle several diameters at once.

The job requires reaming three different diameters in a steel forging for an internal gear. The bars for this job have a standard McCrosky-SUPER shell reamer in combination with a special two-step reamer. The special reamer embodies the same McCrosky-SUPER features used in the standard reamer.

The two-step blades are locked in the reamer body by the SUPER locking device that holds the blades tight and rigid because it works with and not against the cutting thrust. The reamer body is hardened. A large range of adjustment provides for many regrinds and gives long life to each set of blades.

Bulletin No. 12-A will show you all standard styles of McCrosky-SUPER Reamers and other examples of specials. Let us send you a copy for your reference file.

McCROSKY TOOL CORPORATION

MEADVILLE [*Branches in Cleveland, Detroit, Chicago, Toronto*] PENNSYLVANIA

located near the first, provides for stopping the machine instantly in case of emergency, or to change from automatic to hand control.

The hydraulic pressure is provided by a constant-volume pump having a total feeding pressure of 3,400 lb. when the pump is under maximum load. All piping for the hydraulic system is concealed within the column and neck.

The driving motor is of the ball-bearing-mounted open frame type, of 5 h. p. capacity, mounted on the column near the top and at the rear of the machine. Power is transmitted to the mechanism through a multiple "V" drive belt, which drives a pair of hardened alloy steel spiral bevel gears that mesh with hardened alloy steel pick-off gears. These pick-off change gears allow a range of spindle speeds from 100 r.p.m. to 1300 r.p.m. The spindle drive consists of a hardened alloy steel 6-spline sleeve. The machine is equipped throughout with New Departure ball bearings with the exception of the counterweight sheave wheel, which is mounted on Hyatt roller bearings. No bronze bearings or thrust washers are used.

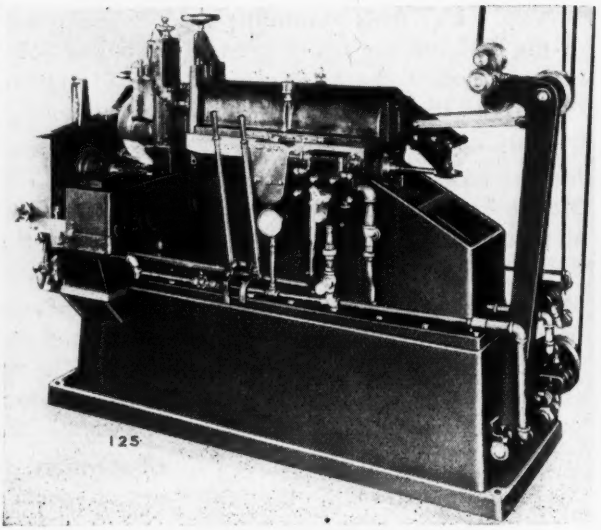
A Cascade lubrication system is used, and the efficient operation of the coolant system is insured by the use of a Ruthman "Gusher" centrifugal pump of 10 gallons per minute capacity. The machine is furnished with complete electrical equipment including a motor, push buttons and magnetic switch having overload and low voltage protection, all of which is wired ready for operation.

The height of the machine is 7 ft. 11 in.; center of driving shaft to face of column is 10 in.; diameter of spindle, 2¼ in.; distance from working surface of base to spindle nose, maximum, 46 in.; minimum, 34 in. Power feed range in inches per min., 0 in. to 15 in.; rapid traverse per min., 95 in. Floor space required, 26 x 50 in. Weight, net, 3650 lb. Drilling capacity, 1¼ in. drill in steel at .008 in. feed per min., 75 ft. per min.

Pratt & Whitney 9-in. Hydraulic Gear Grinder

The Pratt & Whitney Company, of Hartford, Connecticut, has purchased all patents and manufacturing rights for the Garrison Gear Grinder from the Garrison Gear Grinder Company of Dayton, Ohio. Henceforth this machine will be known as the Pratt & Whitney 9 in. Hydraulic Gear Grinder. This gear grinder provides a very fast and accurate method of finishing gear teeth to close limits by generation and is economical for standard manufacturing. It also has great value for salvaging gears.

The operation of the machine is very simple. A reciprocating horizontal ram, somewhat similar to that of a horizontal shaper, carries the grinding wheel back and forth through the teeth, grinding adjacent sides of two teeth at once. The wheel is trued up with straight sides corresponding to the shape of a master rack. The gears being ground are rolled past the wheel under the guidance of a master gear and rack, so that the wheel engages the work in exactly the same manner that a given tooth of the master rack engages the master gear. The wheel makes as many passes per tooth



Pratt & Whitney 9-in. Hydraulic Gear Grinder.

Sheldon 90° Angle Plates

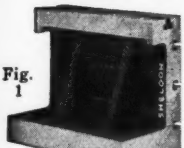


Fig. 1

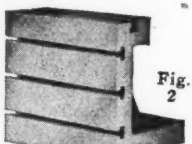


Fig. 2

These Plates are made of semi-steel, heavily ribbed, insuring close-grained, rigid castings.

With Second Face and T Slots

No.	Size Face	Size Top	Size Base	T Slots	Wt., Lbs.	Price, Each
1T	3¾ x 5	1½ x 5	2½ x 5	4–¼″	5	$10.00
2T	6 x 7	2½ x 7	4½ x 7	4–½″	20	15.00
3T	8 x 9	3 x 9	6 x 9	4–½″	38	20.00
4T	10 x12	3½ x12	7¾ x12	4–⅝″	75	30.00
5T	14 x16	4 x16	9 x16	4–⅝″	170	45.00

SHELDON 90o PLAIN ANGLE PLATES

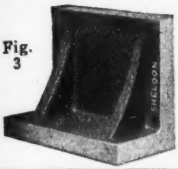


Fig. 3

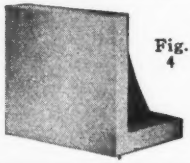


Fig. 4

No.	Size Face	Thickness Face	Size Base	Wt., Lbs.	Price, Each
1P	3¾ x 5	½	2½ x 5	4	$ 8.00
2P	6 x 7	¾	4½ x 7	15	10.00
3P	8 x 9	1	6 x 9	30	14.00
4P	10 x12	1¼	7¾ x12	60	20.00
5P	14 x16	1½	9 x16	145	30.00

Sheldon "Set-Up" Jacks

Fig. 1 Planer Jack

Fig. 2 Vertical Jack

Fig. 3 Bracing Jack

PLANER JACKS (Fig. 1)

No.	Height, Contracted	Height, Extended	Diam., Screw	Weight, Lbs.	Price, Each
1	2¾	3¾	⅞	1½	$1.25
2	3¾	5¼	1⅛	3	2.10
3	5¼	7½	1¼	6	3.00
4	7½	12	1½	12	6.00

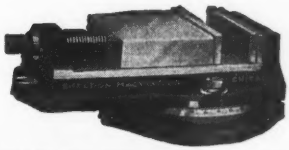
VERTICAL JACKS (Fig. 2)

1	2¾	4	⅝	1½	$ .75
2	4	7½	⅝	2	1.10
3	6¾	12	¾	5½	1.70
4	8¾	15	1	7	2.50

BRACING JACKS (Fig. 3)

1	3¾	6	⅝	1	$ .65
2	4¾	8	⅝	2	1.00
3	6¾	12	¾	3	1.50
4	8¾	16	¾	4	2.10

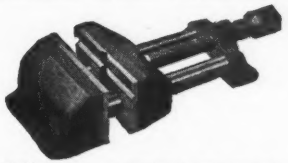
Sheldon Milling Machine Vises



Furnished Both Plain and With Swivel Base.
SPECIFICATIONS AND PRICES:

No.	Width of Jaws	Depth of Jaws	Jaws Open	PLAIN VISE Wt., lbs.	PLAIN VISE Price	SWIVEL VISE Wt., lbs.	SWIVEL VISE Price
3	3½″	1⅜″	2½″	15	$16.00	25	$20.00
4	4½″	1⅝″	3½″	30	$20.00	45	$24.00
6	6½″	2 ″	4½″	70	$30.00	90	$40.00
8	8½″	2½″	7 ″	160	$45.00	225	$60.00

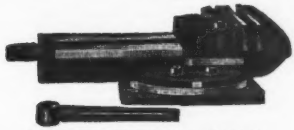
Sheldon Drill Press Vises



Guide Bars are Hardened and Ground.
SPECIFICATIONS AND PRICES:

No.	Width of Jaws	Depth of Jaws over Guide Bars	Full Depth of Jaws	Jaws Open	Wt., lbs.	Price
D 4	4½″	1⅝″	3″	4″	15	$12.00
D 6	6½″	1¾″	3½″	6″	35	$18.00
D 9	9 ″	2½″	4½″	9″	70	$24.00

Sheldon Shaper Vises



SPECIFICATIONS AND PRICES:

No.	Size of Jaws	Vise Opens	Bolt Hole Spacing*	Wt., lbs.	Price
1	12″ x 2½″	12½″	7½″	175	$120.00
2	14″ x 2¾″	13½″	8½″	240	$135.00

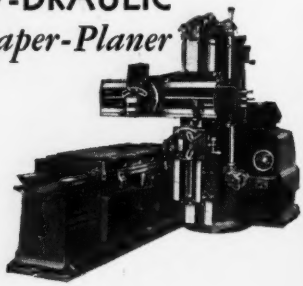
*Distance between holes can be changed without additional charge.

Write for Catalog Describing Full Line of SHELDON Tools For the Machine Shop

SHELDON MACHINE TOOL CO.

3251 Cottage Grove Avenue, CHICAGO, ILL.

The
ROCKFORD
HY-DRAULIC
Shaper-Planer



CONSIDER
These FACTS!

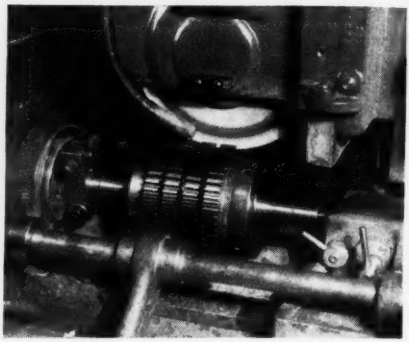
THE Rockford Hy-Draulic Shaper-Planer is as accurate and easily set up as any planer, as convenient to operate as any Shaper. It is *more productive than either*, on work within its capacity, because it has a powerful hydraulic table-drive, adjustable instantly and exactly to maximum cutting speed for the metal being machined—twenty independent hydraulically operated feeds—quick return of *three times cutting speed*—and tools stand up 60% and 80% longer on the Rockford Hy-Draulic Shaper-Planer than they do on machines having rigidly connected mechanical drives.

Purchasing a Rockford Hy-Draulic Shaper-Planer is a highly profitable investment for tool and die shops, railroad shops, in fact for *any* shop having work that taxes the capacity of large Shapers or ties up the time of planers which can be used to better advantage on larger work. Specifications, features of construction and their advantages are described in detail in a new folder—write for your copy today.

ROCKFORD MACHINE
TOOL COMPANY
2414 Kishwaukee St.
ROCKFORD, ILLINOIS, U.S.A.

as are necessary for the finish desired. When the work has rolled to the opposite side of the wheel and out of engagement with it, the rack is lifted out of the master gear, the latter indexed one tooth, and the rack re-engaged automatically. When the work has been indexed one complete revolution the machine stops automatically.

Wheel dressing is accomplished by a built-in device which passes a diamond



View of Grinding Wheel In Operation

along both sides and the top of the wheel, producing the correct angles. By a simple method the wheel always is kept in the same position relative to the work, regardless of wheel truing.

Both the ram of the grinder and the feed are hydraulically operated, which does away with reversing shocks and produces a smooth positive drive. The drive is easily adjusted by a valve to any speed within its range. The general construction of the machine is compact and rigid, with plenty of weight and broad wearing surfaces.

Pratt & Whitney Company will be in production on this new machine in the near future.

Long & Allstatter Series "BA" Steel Power Press Brake

The Long & Allstatter Co., Hamilton, Ohio, is now producing a power press brake with housings, slide and base made from open hearth steel rolled plate. The housings are 2¾ in. thick; the slide is 3 in. thick, and the base is 4½ in. thick, all with ample depth to secure rigidity. The machine is made in four sizes, known as the "BA" series. The smallest size has a width between housings of 4 ft. 6 in., a 6-ft. base, occupies a floor space 5 x 7 ft., is 5 ft. 2 in. high,

HIGH SPEED AUTOMATIC TAPPING MACHINE

Automatic Dial Feed

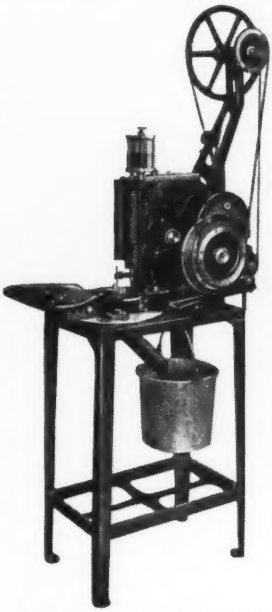
Wide Range

Three Speeds

Simple To Operate

Automatic Knockout

Increases Production



The H & H Automatic Tapping Machine

For the tapping of small parts, the "H & H" Automatic Tapping Machine is ideal.

Forty-five, sixty-five, and eighty-five strokes per minute.

Dial Feed. Operator has but to feed the dial. The automatic indexing and knockout finishes the part.

No complicated jigging required. Machine can be used on many parts.

INDEX MACHINERY CORPORATION

49 CENTRAL AVENUE CINCINNATI, OHIO

Stuart Oils
FOR THE "TOUGHEST" METAL WORKING CONDITIONS

Two Real Recommendations for Getting Smooth Finish:

(1) FOR CUTTING STAINLESS STEELS

Stuart's

Thred Kut

Alloy Steel Cutting Oil

(2) FOR DRAWING STAINLESS STEEL

Stuart's

"SUPER-KOOL"
HEAVY DRAWING COMPOUND

Write or Wire for Free Working Samples of Each!

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NEW HAVEN
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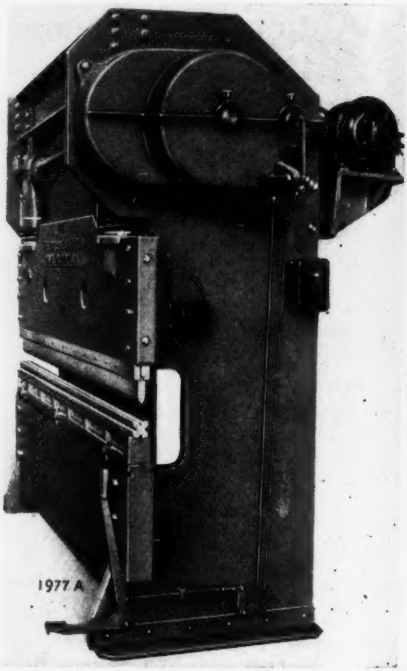
SEATTLE
MONTREAL
TORONTO

D.A. STUART & CO.
LIMITED
CHICAGO U.S.A.
Warehouses in Principal Centers

and makes 30 strokes per minute. The largest machine of this series is 10 ft. 6 in. between housings, has a 12-ft. base, and occupies a space 5 x 13 ft.

All gears are made from steel castings with machine cut teeth, and the pinions are of alloy steel forgings, hardened. The eccentric shaft is of .40 to .50 carbon steel forging, and has large bearings on both sides of each eccentric. The fly-



L. & S. Series "BA" Steel Power Press Brake.

wheel is mounted on roller bearings and is sufficiently heavy to handle the work without overloading the motor. The clutch is of the multiple disc design, plates being provided with asbestos friction lining. Very low unit pressures are required on these discs to do the work required. Adjustment is simple and insures uniform pressure at all points on the discs.

A large friction brake is incorporated in the construction of the machine in such manner that it can be operated by the friction clutch foot and hand levers, thus enabling the slide to be stopped at any point of the stroke. The flywheel shaft is of alloy steel, hardened and

Super POWER for *Super* SERVICE

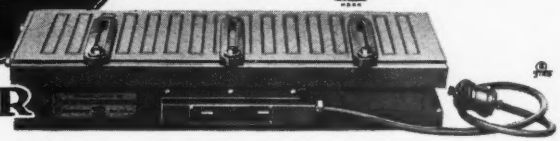
THE magnetic flux density of the super POWER chuck is heavier than that of any other design, producing greater holding power, and a surplus of flux above the face plate that makes possible extremely versatile set-ups, using ordinary steel parallels, angles, etc.

Taft-Peirce Super POWER Magnetic Chucks have a greatly reduced overall height, permitting a very wide range of work. A fine face plate mesh allows the chucking of very small pieces.

Send For Descriptive Folder

The Taft-Peirce Manufacturing Company

WOONSOCKET RHODE ISLAND, U.S.A.



Taft-Peirce
***Super* POWER**
MAGNETIC CHUCKS

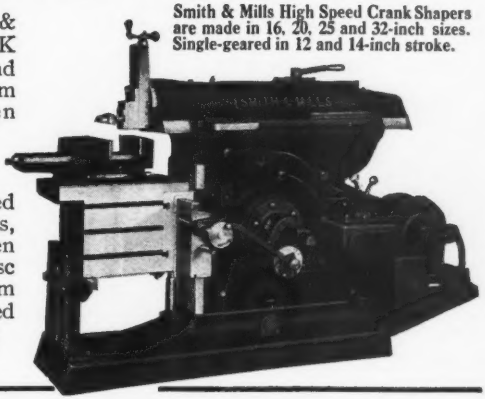
DEPENDABLE SHAPERS

THE dependability of SMITH & MILLS High Speed CRANK SHAPERS to improve results and increase production has made them the choice of production men throughout the industry.

Modern Improvements included in the design of these tools, such as "V" type ram with 55 degree ways, splined shafts, heat-treated alloy steel gears, speed box shafts mounted on Timken Tapered Roller Bearings, Twin Disc Clutch and one shot lubrication system make SMITH & MILLS High Speed CRANK SHAPERS real producers.

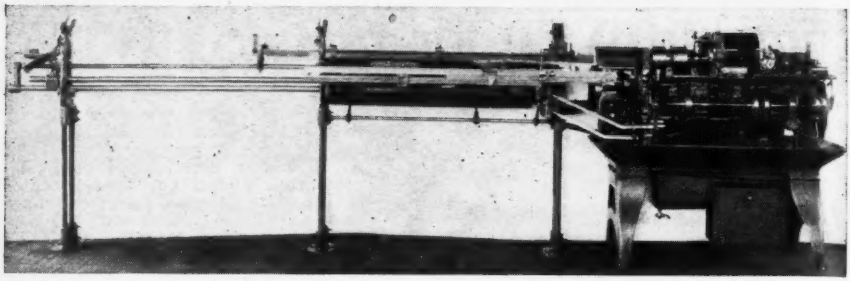
WRITE FOR CATALOG.

Smith & Mills High Speed Crank Shapers are made in 16, 20, 25 and 32-inch sizes. Single-geared in 12 and 14-inch stroke.



THE SMITH & MILLS CO.

CINCINNATI, OHIO



Brown & Sharpe Automatic Rod Magazine for No. 2 B. & S. Automatic Screw Machines

mounted in roller bearings, and the intermediate shaft operates in bronze-lined bearings. Motor-drive, when supplied, incorporates the use of a V-belt to transmit power from the motor to the flywheel.

Power for adjusting the slide is provided by a small individual high torque motor through worms and wheels. The worms are provided with ball thrust bearings. The position of the adjustment is indicated by a pointer and graduated steel scale on the right hand connection. Longitudinal T-slots are milled the full length of the base, both front and back, for attaching gages, fixtures, brackets, or other tools. A cast iron sub-block which will accommodate practically all the various types of dies usable on this machine is furnished as standard equipment. A foot lever for operating the clutch, which can be adjusted and set at any point across the front of the machine, will be furnished if desired.

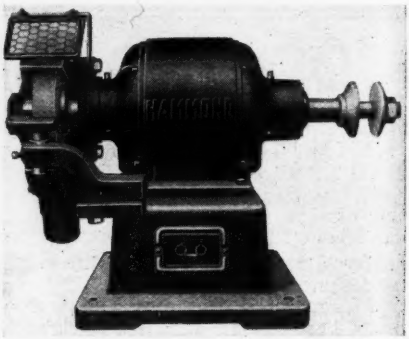
Brown & Sharpe Automatic Rod Magazine

Brown & Sharpe Manfg. Co., Providence, R. I., has announced an automatic rod magazine for the No. 2 sizes of B. & S. automatic screw machines, adaptable to either belt-driven or motor-driven machines in both regular and high speed types. The new size magazine is similar in construction and operation to the other sizes made by this company.

The mechanism of the rod magazine is connected with the feeding arrangement of the screw machine in such a manner that, when the end of the bar on which the machine is working passes a certain point, the machine, with the exception of the spindle, is automatically stopped, the mechanism of the rod magazine is engaged, and a new rod is fed from the magazine into the spindle and to working position. The machine is then started automatically. Sufficient rods can be inserted into the magazine at any time to keep the machine operating for a long period of time, depending upon the type of work in process.

Hammond Type "LW" Combination Grinder and Buffer

The illustration shows the Hammond Type "LW" Combination Grinder and Buffer, which has been placed on the



Hammond Type "LW" Combination Grinder and Buffer

market by Hammond Machinery Builders, 1622 Douglas Ave., Kalamazoo, Mich. The machine is intended for general purpose work and is built in ½, 1½, and 2 h.p. sizes. The general construction is the same as that used in all Hammond grinders and polishers. The grinding wheel can, however, be mounted on one side of this machine with the buffing, polishing or wire scratch wheel on the opposite side.

FOSDICK

High Speed Ball Bearing Sensitive Drill

—"Gangs" up to 6 Spindles—

SENSITIVE ACCURATE
RIGID ADAPTABLE

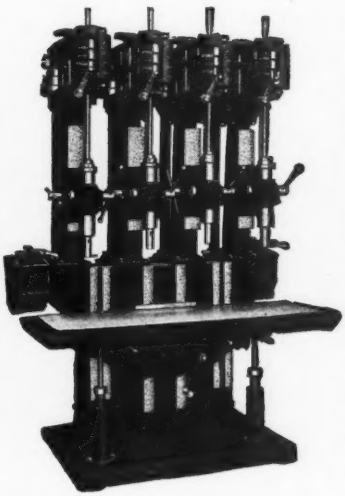
Ball Bearings on all revolving parts.

Spiral Gear Drive; hardened spiral gears running in oil.

Patented Belt Shifting Mechanism, using a central cam drum, controlled by crank.

Four-cone pulley gives four speeds. Range of three sets of speeds to choose from.

Channel for chips and lubricant around table.



Spindle of Chrome Nickel Steel, accurately ground.

Spindle Sleeve is supplied with one thrust and two radial ball bearings.

Head is adjustable and can be clamped in position.

Power Feed. Four geared feeds for each spindle. Feed-engaging clutch and all gears are enclosed.

Patented Tapping Attachment is clamped to quill or sleeve and is disc-driven.

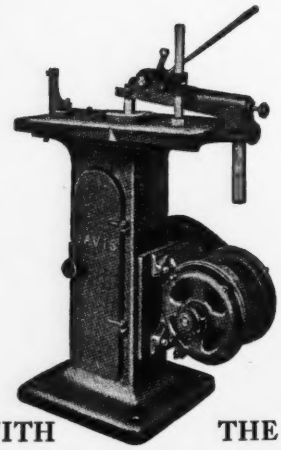
Developments far ahead of general practice in building machines of this type are embodied in the design on this machine. Especially intended for use on the rapid, accurate drilling operations met in modern high-production manufacturing plants.

Ask For Specifications

THE FOSDICK MACHINE TOOL CO.

CINCINNATI, OHIO, U. S. A.

2 MINUTE SET-UP



WITH THE

Davis Keyseater

TWO MINUTES is all that is required to set up the Davis Keyseater. It is always ready for any job up to 1" wide in parts up to 12" high. It cuts straight or tapered keyways with equal efficiency.

Speed, operating convenience, and accurate results on production, short runs, or special work are profitable features which you cannot afford to overlook. Investigate these features today.

SEND COUPON NOW!

DAVIS KEYSEATER CO.
250 MILL STREET, ROCHESTER, N. Y.

I am interested in the Davis Keyseater. Send me Complete Catalog.

Name ..... Title.....
Firm .....
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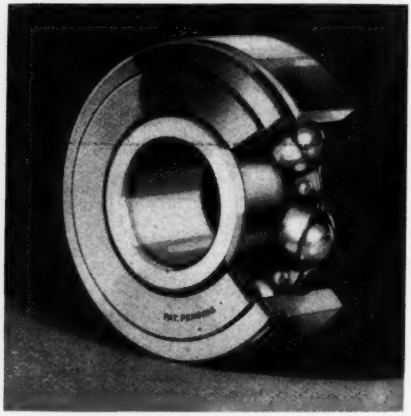
M.M.S.7

The motor is especially designed for the machine, and is capable of withstanding excessive overload. It is built in accordance with N.E.M.A. recommendations. The 1½ h.p. and larger machines are equipped with push-button control and automatic starter, thus protecting the motor from overload, low voltage, and phase failure. The machine is furnished for alternating current in 110, 220, 440, and 550 volt, 25 to 60 cycle, 1, 2 or 3 phase. Direct current, 110 and 220 volt.

Norma-Hoffmann "Greaseal" Bearing

The Norma-Hoffmann Bearings Corporation, Stamford, Conn., has developed an entirely new line of "Greaseal" bearings for the special purpose of reducing costs of machining and mounting, by eliminating a number of housing parts



Norma-Hoffmann "Greaseal" Bearing

which otherwise would be necessary for the mounting and protection of the bearing.

The new product is a combination of the usual standard annular closed type of bearing with a seal feature that consists of steel side plates with felt interposed, closing one side of the bearing. The extension of the inner ring completes the seal, which makes the combination particularly effective in retaining the lubricant as well as in sealing the lubricant against dirt and other foreign matter. The all-steel construction, load-carrying capacities equal to those of the standard series, the standard width of the outer ring, and the added

There is a LOGAN Air Operated Device For Every Requirement!

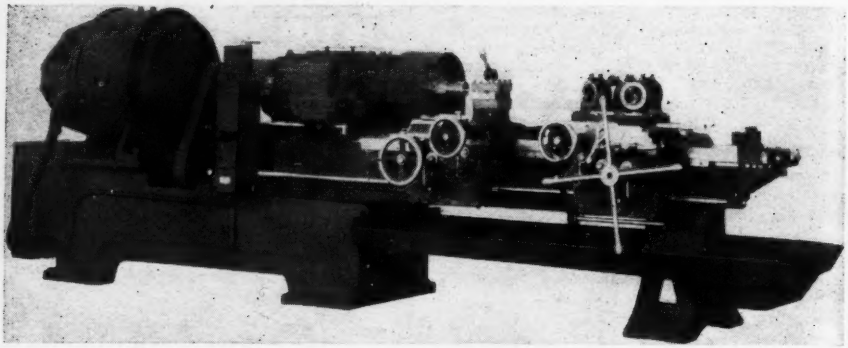
NO matter what you require in the way of air operated equipment—chucks, air cylinders, valves, etc.—there's a LOGAN Device for your need.

Here is a specimen page from each classification in the New 64 Page LOGAN Catalog. These pages will give you a good idea of the scope of LOGAN Air Operated Equipment.

Be sure you have this catalog. Study it—order from it, now or later. Just tear out this advertisement, sign your name on the margin, mail it to us and we'll send you your copy.

THE LOGANSPORT MACHINE CO.

LOGANSPORT, INDIANA



Acme "Duo-Control" Turret Lathe With Special Drive for Using Tungsten Carbide Tools

seal feature which provides for a large grease capacity make this series especially adaptable for both high and low speeds.

Acme Special Drive "Duo-Control" Turret Lathe

In order to obtain full efficiency from the use of tungsten carbide tools in the machining of phosphor bronze bearings, the Acme Machine Tool Co., Cincinnati, Ohio, has adapted a special drive to its "Duo Control" turret lathe. A 25 h.p. adjustable speed motor connected direct to the spindle by a flexible coupling eliminates intermediate gearing and supplies ample power. Full load spindle speeds of from 300 to 1,200 r.p.m. are obtained and are adjusted by means of rheostats, one of which is a vernier for the finer adjustments. Starting, stop-

Haskins HS-4 Equipment

HASKINS FLEXIBLE SHAFT EQUIPMENT

—provide an ideal combination — hand-tool flexibility coupled with power.

Haskins saves time and labor, thereby quickening output and increasing profits. Durably built, vibrationless and efficient, they answer the need of every modern machine shop.

We welcome the opportunity of telling you more.

Die Grinding with Haskins HS-4 Equipment

Write for descriptive catalog on the entire Haskins Line.

Write for circular "HASKINS Equipment for the Machine Shop."

R.G. HASKINS COMPANY

Portable Flexible Shaft Machinery

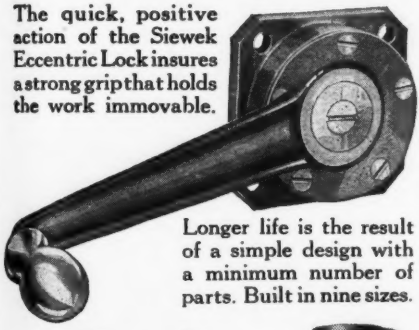
4653 W. FULTON STREET, CHICAGO, ILL.

Branch Offices in Principal Cities

Siewek Drill Jigs

The *Cushion Clamping* of Siewek Drill Jigs conserves energy, allows closer drilling accuracy, reduces loading time, and increases production. These jigs have large wearing surfaces to withstand hard usage and to maintain their accuracy. It is built in eight types.

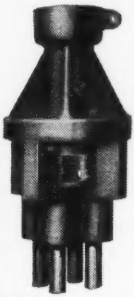
Siewek Eccentric Locks



The quick, positive action of the Siewek Eccentric Lock insures a strong grip that holds the work immovable.

Longer life is the result of a simple design with a minimum number of parts. Built in nine sizes.

Siewek Drill Heads



Siewek Drill Heads, when used in combination with Siewek Drill Jigs, insure a tool set-up that will give maximum production over a long period of time. There is a Siewek Drill Head to meet every requirement.

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Siewek Tool Co.

10232 Woodward Ave., Detroit, Mich.

The PULLMORE CLUTCH

Sets New Standards—

In EFFICIENCY, as it removes the troubles and complaints from that most vital point on most machinery, the clutch.

In ADAPTABILITY — it permits a clutch application on the most correct principles for power transmission, giving positive and convenient control of machine functions. It is furnished to run in oil-bath, or dry, and capacities are from two to twenty-five horsepower at 500 R.P.M., varying with the R.P.M. Single and Double types are furnished.

In COMPACTNESS, as it reduces the necessary clutch space to the very minimum, enhancing the machine design without sacrifice of dependability.

Adjustments are seldom required, but when necessary effected with exceptional ease.

The PULLMORE Catalog describes the features making these new standards possible. Send the coupon for a copy.

Rockford Drilling Machine Co.

10 Catherine Street ROCKFORD, ILL.

Rockford Drilling Machine Co., Rockford, Illinois.
Send me a copy of the PULLMORE Industrial Clutch Catalog.
Name .....Title.....
Firm .....
Address .....
City..... State.....

The Smallest Air Drill Made

Weight 3 lb. 12 oz.

ROTARY AIR DRILL

A small, compact air drill that is cutting costs in hundreds of shops. Its perfect balance, ease of handling and power make it ideal for practically every drilling job of ¼ in. or smaller. The absolute absence of vibration in this midget type tool prevents breakage of the smallest drills.

Made in two sizes: No. 01 with a capacity of $\frac{1}{8}$ in. and speed of 3,000 R.P.M., and No. 02 with a capacity of ¼ in. and speed of 2,000 R.P.M. A test in your plant under your own conditions will prove that these small drills will cut your production costs. Write for circular No. 109.

TOOLMAKERS SINCE 1893

INDEPENDENT PNEUMATIC TOOL CO.

236 SOUTH JEFFERSON ST., CHICAGO

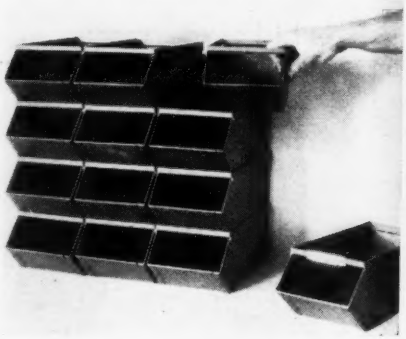
ping and braking are controlled electrically.

The spindle bearings are of the standard Acme construction, with a double set of Timken bearings on the nose and a floating rear bearing. A positive lubricating system is supplied for the spindle bearings. The lubricant is passed through a Purolator by an oil pump which is driven by a constant speed motor that also drives the turret quick motion mechanism. Twelve independent reversible feed changes are provided for each carriage, all of which are located in their respective aprons, thus centralizing the control. The feed changes are made by means of sliding gears mounted on squared shafts which, in turn, revolve in anti-friction bearings. The mechanism is entirely enclosed and revolves in an oil bath.

The main carriage can be furnished with either fixed center or with cross sliding turret, either of the hexagon or flat type. Power rapid traverse is also incorporated for longitudinal movement of this unit. The square turret carriage is rigidly mounted on both front and rear V's of the bed, providing firm support for tooling. Regular engine lathe taper and chasing attachments can be furnished.

Simplex Nesting Bin

The Simplex Tool Company, Woonsocket, R. I., has developed a nesting bin which can be used to advantage on



Simplex Nesting Bins In Stack

the bench, in the tool crib, or in the stock room. The bins are designed to "nest" or fit together so that they can be built up to any height, openings being left at the same time so that stock may be removed from any bin without

Nielsen Live Centers

Stand the "GAFF"!

THE stamina of NIELSEN Live Centers has been proven in a recent demonstration of tungsten carbide cutting tools at the Case School of Applied Science.

A standard No. 6 NIELSEN Live Center was placed on a turret lathe equipped with a tungsten carbide cutting tool. A cut 5/8" deep with a feed of .037" per revolution was taken in cast iron at a cutting speed of 500 surface feet per minute.

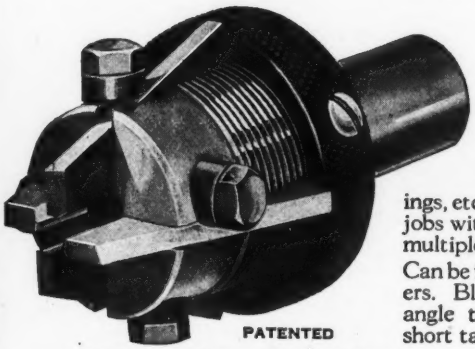
Next steel with an analysis of .50 carbon, .75 chrome and 1½% nickel was turned. A cut ¼" deep with .037 feed per revolution was taken at a cutting speed of 200 feet per minute. The center stood up under this cutting load without chatter and showed no sign of breaking down or burning.

There is a NIELSEN Live Center for every center requirement — write for bulletin.

NIELSEN, INC.
LAWTON, MICHIGAN

Genesee Adjustable Hollow Mill

Made in 7 different styles



PATENTED

Has adjustable, replaceable blades and can be replaced at nominal cost, making it unnecessary to continually buy new tools.

The ideal tool for finishing your forgings, castings, etc. Do your several operation jobs with Genesee inserted blades multiple operation tools.

Can be fitted with drills and reamers. Blades can be ground any angle to point work and turn short tapers.

A Genesee Adjustable Hollow Mill can be made for every job

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GENESEE MANUFACTURING CO., Inc.
ROCHESTER, NEW YORK

disturbing the others. The bins are furnished in three sizes, with or without card holders, as follows:

No. 1, 4 x 5½ x 10 in.
No. 2, 5¼ x 7½ x 12½ in.
No. 3, 6½ x 9 x 15 in.

Simplex bins are ruggedly constructed and are so designed that they cannot unstack. They must be lifted one out of the other. The metal edges, at the point where the hand enters, are rounded over so that a smooth edge is presented. All bins are lacquered olive green. Special sizes can be furnished to meet individual requirements.

Armstrong Tungsten-Carbide Tool Holders

The Armstrong Brothers Tool Co., 328 N. Francisco Ave., Chicago, Ill., has announced a new line of tool holders which are designed to hold tool bits that are tipped with less than an ounce of tungsten-carbide. Because of the extreme brittleness of tungsten-carbide tools, the holders are made extremely rigid and are built out under the bit so as to afford a maximum of support to the cutting edge. The holders are designed for use on lathes, shapers, planers, or other similar machines, and are of two general types; those broached for the standard square bits and those that are made to take deeper bits to which sufficient thickness has been added to compensate for the stock displaced by the tungsten-carbide tip.

Starrett Cutter Clearance Gage

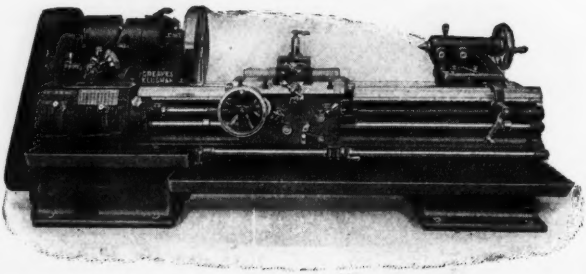
A cutter clearance gage designed for use in determining clearances on all types of milling cutters from ½ in. to 30 in. or more in diameter has been developed by the L. S. Starrett Company, Athol, Mass. This gage, which is known as the No. 459, gives precise readings in degrees on all types of cutters within its range. It is adaptable to end, side, helix, spiral or inserted-tooth cutters, with equal accuracy. In addition, it helps materially in checking clearances on many special types of cutters.

The gage consists of a tool steel beam, fitted with one stationary foot having its contact edge parallel with the beam; a sliding foot, its edge also parallel with the beam, and an upright blade which is adjustable both perpendicularly and angularly. The upright blade is graduated in degrees from 0 to 30. Three simple adjustments are required in

What

G. K. SINGLE LEVER CONTROL

Will Do For You!



TO CUT production costs you must eliminate the non-productive minutes lost in shifting speeds. And, that is what the G. K. Single Lever Control will do for you.

It saves these lost minutes . . . there are no combinations of levers to search through for the correct speed. Just one lever through which to select any speed of an extremely wide range!

Besides this G. K. advantage, you get centralized control . . . closer concentration on the work . . . increased production . . . maintained production schedules . . . and long, dependable service.

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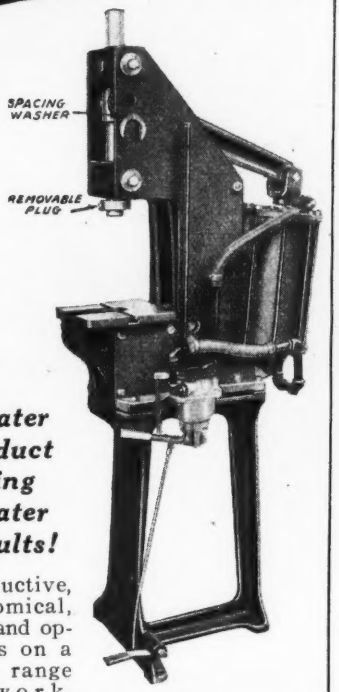

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Productive, economical, fast, and operates on a wide range of work. Popular Hopkins tubular-type air cylinder is standard equipment. Standard sizes: No. 1 press, 1,100 lbs.; No. 2 press, 3,000 lbs.; No. 3 press, 6,500 lbs.; No. 4 press, 12,000 lbs.; No. 1½ press, 2,000 lbs.; No. 2½ press, 4,500 lbs.; No. 3½ press, 9,000 lbs.; No. 4½ press, 18,500 lbs.

Write for literature, prices

THE TOMKINS-JOHNSON CO.

Agents in all Principal Cities

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We also manufacture: Hopkins 3- and 2-jaw Pneumatic Chucks, Series B and C Pneumatic Air Cylinders, Collet Chucks, Coolant Pumps, Die Sinking Milling Cutters and Special Equipment.

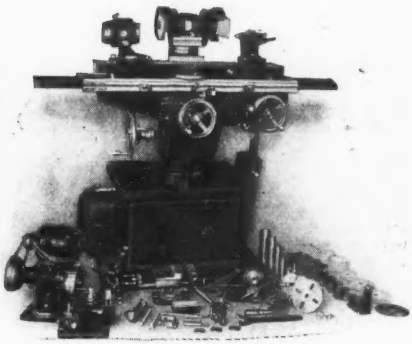
GRIND YOUR TOOLS

—on the—

GRAND RAPIDS

UNIVERSAL

TOOL AND CUTTER GRINDER



KEEPING your tools properly ground means that they will cut faster, stay sharp longer and produce better work.

The GRAND RAPIDS UNIVERSAL TOOL and CUTTER GRINDER—built in five sizes—is the ideal machine for this purpose. All types of cutters can be accurately ground on this machine in less time than by any other method.

Dual control for operation from either the front or rear, and a self-contained motor drive which eliminates overhead shafting and belts are just two of the features which make the GRAND RAPIDS UNIVERSAL TOOL and CUTTER GRINDER so desirable in all shops.

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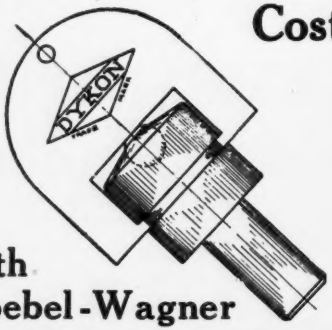

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DIAMONDS!

ARE your precision grinding wheels doing precision work . . . or, are they dull and unevenly worn? The point is that unless you keep them true and smooth, precision work cannot be obtained at reasonable costs!

Koebel-Wagner Diamonds will true your wheels better — quicker — and with less waste. Each diamond is set in a Safety-Mounting which securely holds the stone in place and prevents loss. These diamonds are protected against abuse by the "Dykon" Gage. This is a small Koebel-Wagner Device which indicates at once when the diamond is worn to its lowest level and requires resetting.

Scores of leading manufacturers thruout the country have found that the use of Koebel-Wagner diamonds lowers their grinding costs and gives better results. These diamonds will lower your costs as well . . . let us show you how . . . send the coupon TODAY!

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How can I cut my grinding costs by using K-W Diamonds?

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Firm .....

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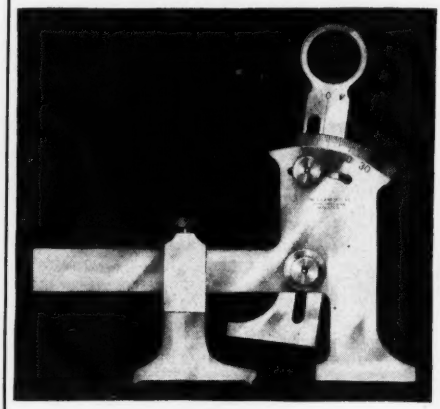
order to take a reading. The measuring of side clearances on large-diameter, coarse-pitch cutters is a simple operation because the contact edge



Starrett Clearance Gage No. 459

of the sliding foot is in line with the edge of the stationary foot. The perpendicular and angular adjustments of the upright blade are independent of each other, allowing easy and precise determinations. The gage can be applied without disturbing the cutter when the cutter is in position in the machine.

Hyro Automatic Industrial Furnace

An automatic furnace for heat treating, case hardening by the use of cyanide and other salts, and so on, designed so as to eliminate most of the disagreeable features of this work, has been developed by the Hyro Manufacturing Co., 200 Varick St., New York, N. Y. The outstanding features of the furnace are ease of operation and safety. A unique carrying mechanism handles the baskets of work in and out of the hardening bath, into the quenching bath, and to the receiving basket, the entire movement being controlled by levers on the outside of the furnace. The furnace and quenching tank are enclosed in air-tight hoods which prevent the fumes and gases from passing out into the surrounding atmosphere. All danger from spilling or splashing the solutions is eliminated, the work being entirely enclosed at all times.

Required temperatures are quickly obtained and easily maintained. Solutions cannot drip onto the floor, as the carrier

AMERICAN V-2 Broaching Machine

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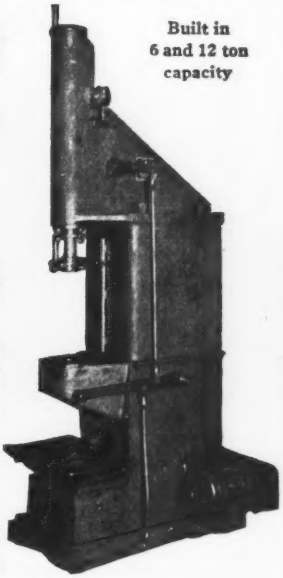

Built in 6 and 12 ton capacity

HYDRAULIC PRESSURE is smooth acting, positive, and powerful—the ideal for accurate broaching. That is why the American V-2 Broaching Machine is equipped with hydraulic feed.

It gives the ram a steady, smooth, downward stroke, and at a speed of 20 feet per minute has enough reserve power, up to 6 tons, to complete the stroke at this speed. As soon as the stroke is completed the ram automatically returns to the starting position.

This feature and many others are completely described in our bulletin—write for it TODAY!

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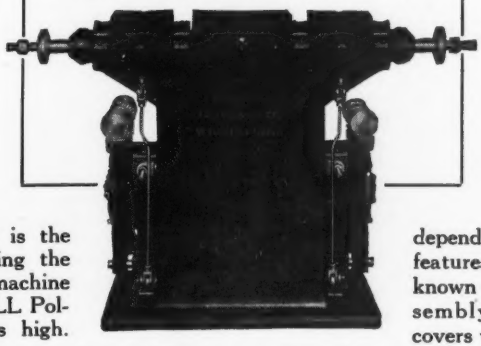
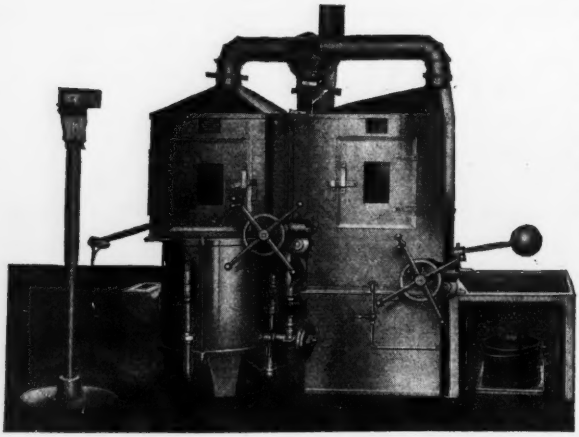


When *SERVICE* is the means of measuring the *QUALITY* of a machine ... this MITCHELL Polishing Lathe rates high. This quality is the result of careful design and sturdy construction, incorporating many features which insure a long life of dependable service. These features include the well known Mitchell unit assembly, new type flat covers which afford a convenient place to lay tools, etc., foot brakes, "V" belt drive and many others. Let us explain them ... write for a bulletin *today!*

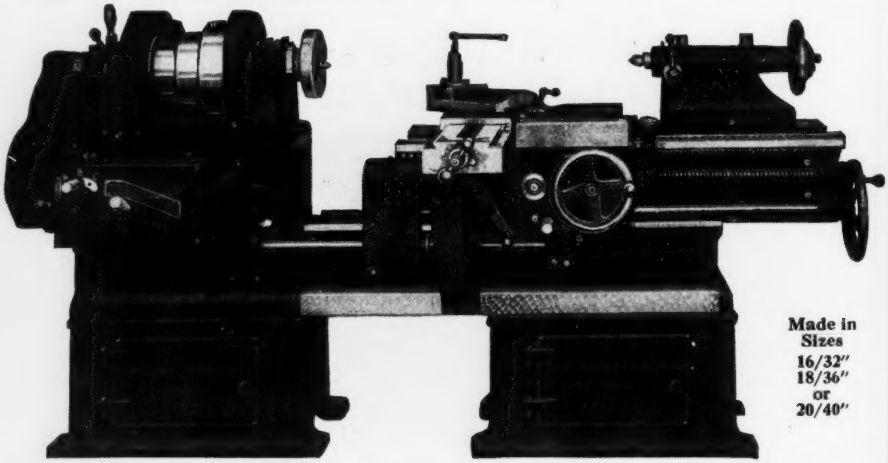
The Mitchell Engineering Co., Springfield, Ohio



Hyro Automatic Industrial Furnace

and furnace plates are so constructed that all excess liquid runs back into the pot. The carrying mechanism is completely enclosed, preventing the cold air from reaching the work and thus increasing the life of the pot. Premature cooling of the work is impossible. The outfit occupies a minimum of floor space, due to the compact arrangement, and it can be placed anywhere in the plant, as the fumes cannot escape.

The furnace and tank are self-contained, each being covered by a hood. The hoods are joined together by a sealed passageway and the windows are provided with Pyrex glass, which will permit of inspection without opening the doors. The work is placed in a basket which is first submerged in the hardening solution. At the proper time the basket is swung out of this solution and into the quench by means of a handle that operates the mechanism through a worm and worm gear. The loaded basket is balanced by a counterweight. The quenching tank is equipped with a baffle plate, which can be furnished in suitable design to separate or "break up" the work as it is dumped into the quench. A reverse motion of the handle returns the basket for another load. When properly quenched, the work is dumped, by means of another lever, into a hopper through which it passes into the receiv-



Made in Sizes
16/32"
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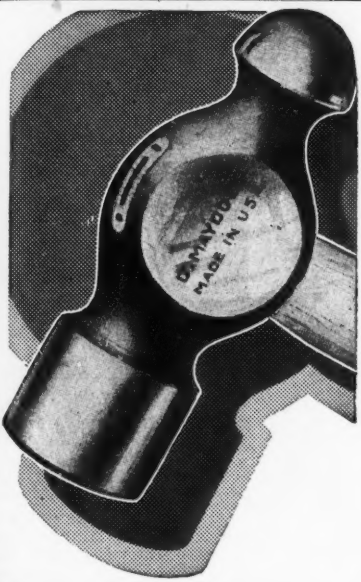
Rahn-Larmon 18/36" Extension Bed Gap Lathe

A lathe for large or small swing work, ready at all times. Requires no extra rigging up. Takes different distances between centers.

Belt driven or with nine speed all geared motor driven head. Tell us what your requirements are and let us quote you.

THE RAHN-LARMON CO. 2935 Spring Grove Ave., Cincinnati, Ohio



The Choice of Skilled Machinists

Built with as much care as the finest precision tools, Maydole Hammers have balance, strength and a stubborn resistance to wear.

Press-forged tool steel heads, clear second growth hickory handles put into the heads "for good"—a Maydole will outlast two ordinary hammers for shop work.

Your dealer carries Maydoles, ask him for the weight you like.

Please send me a free copy of Pocket Handbook 23-P, containing useful tables and handy information.

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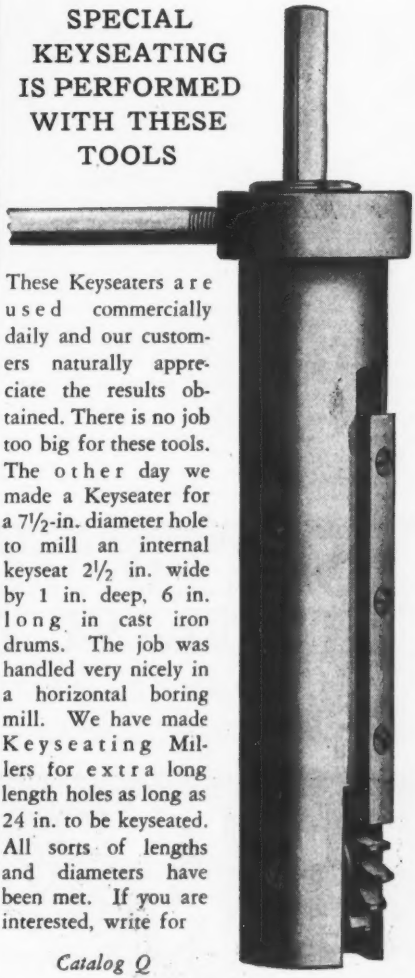
Production *as well as*

SPECIAL KEYSEATING IS PERFORMED WITH THESE TOOLS



These Keyseaters are used commercially daily and our customers naturally appreciate the results obtained. There is no job too big for these tools. The other day we made a Keyseater for a 7½-in. diameter hole to mill an internal keyseat 2½ in. wide by 1 in. deep, 6 in. long in cast iron drums. The job was handled very nicely in a horizontal boring mill. We have made Keyseating Millers for extra long length holes as long as 24 in. to be keyseated. All sorts of lengths and diameters have been met. If you are interested, write for

Catalog Q

National Machine Tool Co.

2271 Spring Grove Avenue

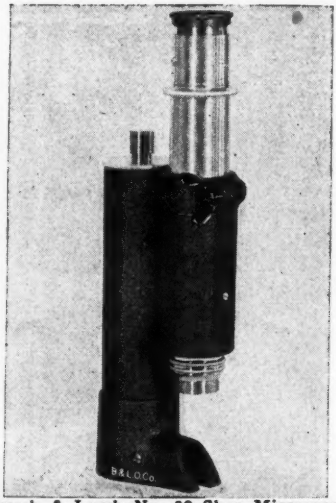
CINCINNATI, OHIO, U. S. A.

ing basket. An accurate heat indicator provides temperature readings at all times. This indicator is portable and can be used for a battery of furnaces because it is equipped with a two-way switch.

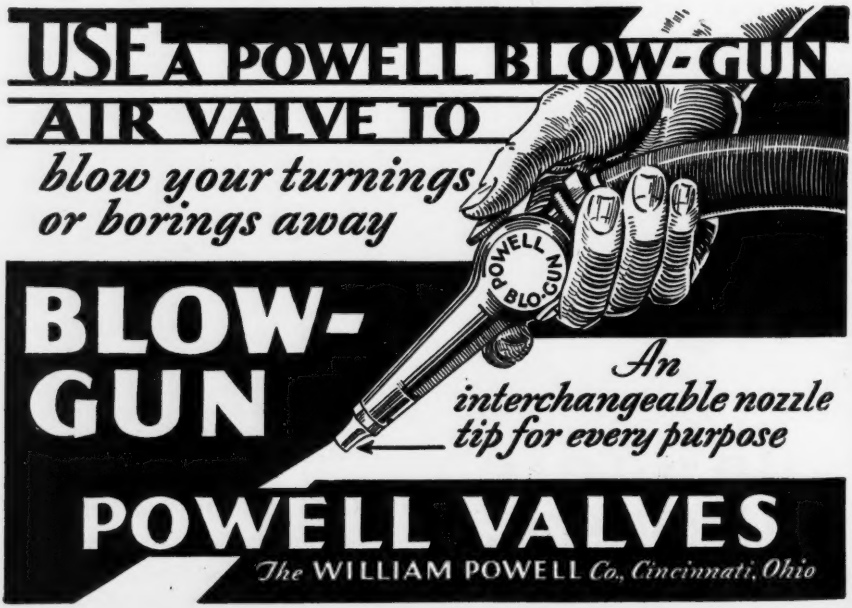
The furnace is provided with an exhaust blower which mixes the cold air from the quenching tank with the hot fumes from the furnace and thus obtains a mixture at low temperature which prolongs the life of the fan and motor. Each furnace is constructed so that another can be placed alongside of it, using the same hopper discharge for both units.

Bausch & Lomb Shop Microscope

A microscope especially designed for shop use has been placed on the market by the Bausch & Lomb Optical Company, Rochester, N. Y. The microscope—known as the No. 32—is a small, portable and rugged instrument, intended for use in making rapid examinations and measurements of surface characteristics, and is admirably adapted for the bench or inspection table. A scale in the eye-piece, calibrated in thousandths of an inch, enables the operator to measure the extent of a flaw, crack, or other characteristic to determine the quality of the piece or adherence to specifications. A quarter-thousandth is easily estimated with this instrument. The microscope magnifies 40 times and has a field up to 7-32 inch. It is self-illuminating, is 7¾ in. high, and weighs only 1½ pounds. The finish is black enamel and chromium.



Bausch & Lomb No. 32 Shop Microscope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STUD SETTERS

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¼" to 2½"

All studs set to uniform tension with Apex Friction Chuck.

Set by power instead of by hand. Time saved pays for tools.

With M. T. Shank for air tool or hex shank for electric tools.

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The APEX MACHINE CO.
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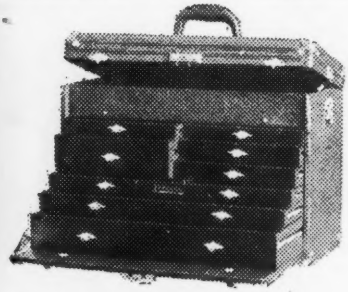
MACHINISTS AND TOOL-MAKERS TOOL CHESTS



Tool Chests that are right in construction and price.

Send for No. 25 Catalogue of Tool Chests and Tools.

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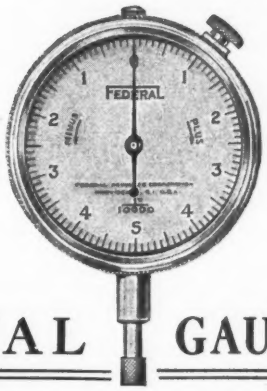
The New FEDERAL "MILLIONWEAR"



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A WELL KNOWN manufacturer of automobile parts was having trouble with dial gauges on a certain operation. No make would stand up for more than a week and a half.

Then . . . we sent him a New Federal Millionwear, which now has been in service more than six months and is still operating perfectly.

The improvement in the "Millionwear" consists of new type gears and pinions, which maintain the accuracy of the indicator for a long period of time . . . at no increase in price!

Send for a bulletin . . . it describes an endurance test which proves the value of the New Federal "Millionwear" Gauge.

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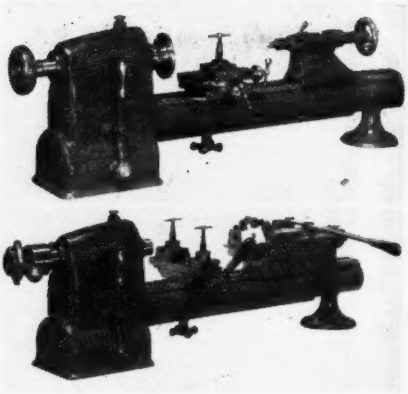
Hardinge "Cataract" Bench Lathe and Hand Screw Machine

The machine shown in the illustrations is the "Cataract" motor-driven bench lathe and hand screw machine, which has been developed by Hardinge Brothers, Inc., 4151 Ravenswood Avenue, Chicago, Ill. The machine can be adapted for use either as a bench lathe or hand screw machine by substituting the turret for the tailstock and changing other minor parts of the mechanism, as shown in the illustration.

The machine is designed with a completely-enclosed headstock, in which V-belts serve to transmit power. The drive from the reversing unit to the headstock spindle is obtained by the use of three V-belts which transmit power to the spindle without chatter. The spindle construction is the same as that used on the cone-driven machines made by this company, as are also the collets.

The bed of the machine is similar in design to the lathe-beds formerly used on this company's product, excepting that it is somewhat heavier. The tailstock is also heavier and is equipped with a tailstock locking device. The taper in the tailstock spindle is No. 1 Morse.



(Above)—Hardinge "Cataract" Bench Lathe.
(Below)—The machine adapted as a hand screw machine.

Six speeds are available, the transmission having a speed range of from 140 to 1600 r.p.m. with high and low speed controlled by a clutch located in front

Spiral Gears

are easy on a

BOLENDER

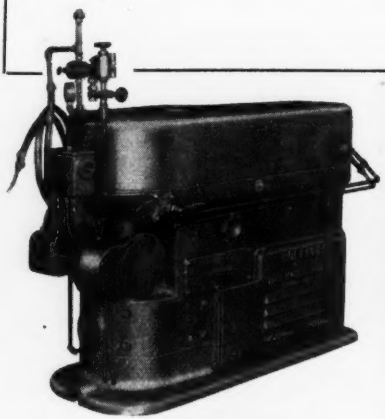
WITH the modern trend toward quietness in the transmission of power spiral gears are coming into more common use.

The Bolender is easily arranged for burnishing spiral gears and turns them out accurately at speeds worth investigating.

The simplicity of this compact machine both in construction and operation and its wide range of application is amazing. It will cost you nothing to get fully acquainted with all the possibilities of this husky gear burnisher. Write for literature or ask for a representative to call and tell you all about the Bolender.

City Machine & Tool Works

E. Third at June, Dayton, O., U.S.A.



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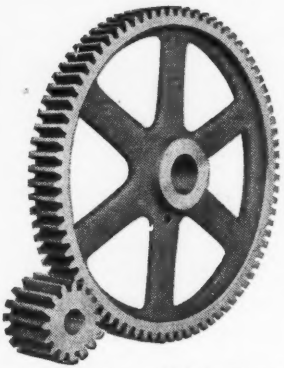
CM&T

Other C M & T products include the Bolender Gear Grinding Chuck and Peerless Gear Chamfering Machine.

GEARS



All types and sizes up to 12 ft. in diameter. Rush service for breakdowns. Also a complete line of speed reducers.

The Horsburgh & Scott Co.
5110 Hamilton Ave. Cleveland, Ohio

DRILL
VISE
With and Without Jig Attachments

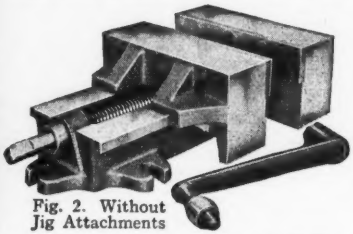
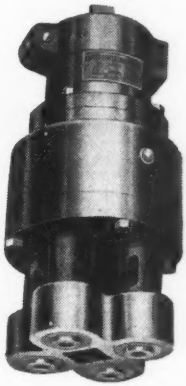


Fig. 2. Without Jig Attachments

A good one for general shop use on Driller, Miller, Shaper or Planer. Flanged all around bottom for bolting down, with three slots at large end not shown.

ANY VISE WILL PAY

THE GRAHAM MFG. CO.
69 Willard Ave. PROVIDENCE, R. I.



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From Single Drills

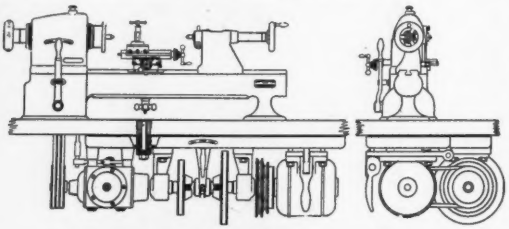
Designed to fit any type of drill press, a U. S. Drill Head converts any single spindle drill into a multiple unit quickly.

No time wasted making adjustments—spindles are fixed. Any number of holes, fifty if necessary, can be drilled as easily as one.

We will design a U. S. Multiple Drill Head to meet your individual requirements. Tell us your needs. Address

The United States Drill Head Co.
1954 Riverside Drive
Cincinnati, O., U. S. A.

of the bench. The reverse is controlled through a Pullmore clutch to a reversing gear box, the control handle being located in the bed and coming up in front of the headstock. The six speeds are



Drawing showing under-bench transmission of Hardinge "Cataract" Bench Lathe.

obtained by means of high and low speed pulleys on the transmission, in conjunction with a three-step cone pulley mounted on the motor shaft. To expedite the changing of belts on the cone pulley, the motor is mounted on an adjustable plate so that tension on the belts can be relieved while shifting. The transmission shafts run in self-aligning grease-packed ball bearings which will not require attention oftener than once in six months. The transmission is connected to the bench with rubber mountings between the transmission and the bench-top, which deadens vibration.

The reversing unit is independent of the transmission and the machine can be had with or without a reverse. This unit eliminates the necessity for a reversible motor, and the reverse action is instantaneous, which is considered necessary for light production tapping and similar work. Under test, cuts ⅝ in. deep were taken with .005 in. feed.

The machine is made in a range of five sizes with collet capacities of from ½-in. to 1 in. and with swings of either 7 or 9 inches.

Bradford Machines Adapted for Machining Auto Parts

The illustration shows a battery of machines that have been developed by the Bradford Machine Tool Company, 659 Evans St., Cincinnati, Ohio, for performing two progressive operations on the front and rear brake housing hangers for an automobile. Each ma-

WHITON LATHE CHUCKS

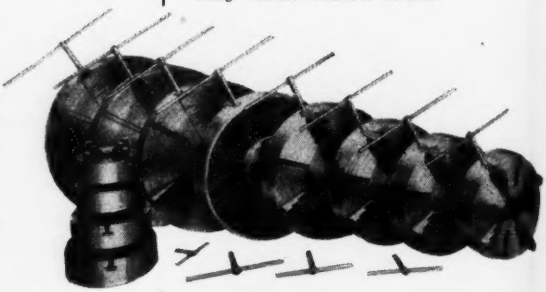
For a Sure Grip!

WHEN work must be held rigidly and securely for accurate machining at top speeds — WHITON Lathe Chucks prove their superiority!

WHITON Chucks—and there's one for every requirement—are good chucks. Their design and workmanship assure you dependable service over a long period of time.

Get a WHITON Catalog—it shows the complete line of WHITON Chucks as well as many special chucks built for special requirements.

Here is a group of WHITON Steel Body Independent Chucks designed to hold heavy work under heavy cuts at high speed. The one-piece body resists sudden strain.



THE D. E. WHITON MACHINE CO.

NEW LONDON CONN.

Boiler Clamps

Electric Steel Deep Throat, Medium Weight.

Made in three sizes

Openings from 2½ to 6 inches

Send for catalogue No. 80, showing other types and Lathe Dogs and Expanding Mandrels, etc.

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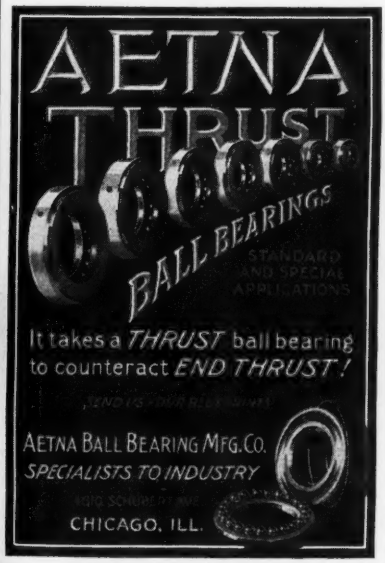
SOUTH NORWALK, CONN.



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for better RESULTS!

When you use a Connecticut combination round and spline broach you are assured of great savings in time, reductions in tool costs, and a more accurate job. These results are positive because this tool broaches the drilled hole to size, cuts the splines and removes the burrs *in one operation*.

You cannot afford to overlook these possibilities in your plant. Send us a description of your work and we'll recommend a broach that is guaranteed to give you better results!

***The* CONNECTICUT BROACH & MACHINE CO.**
NEW LONDON, CONN.

Battery of Bradford Standard-Unit Machines, Arranged for Machining Brake Housing Hangers

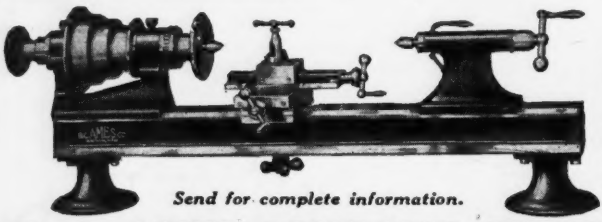
chine is arranged to perform each of the operations on the two parts. The machines represent a typical adaptation of the unit-built type of special machine tool as manufactured by this firm, all machine elements such as tables, pedestals, columns and drilling and tapping units being standard units assembled to meet the requirements of this particular task.

The first operation on the two parts consists in drilling two 15-32-in. holes 1⅛-in. deep at the points **A** and **C**, for which the horizontal units are used, and counterboring the hole **B** with a combination tool of 1.123 and .600 in. diameter. These tools operate at a cutting speed of 118 ft. per min. on malleable iron, the floor to floor time being 35 seconds each.

The second operation consists in reaming the holes **A** and **C** to .500 in. diameter by 1¼ in. deep and tapping the hole **B** to ⅝-in. 11 thread. The reamers are operated at a cutting speed of 109 ft. per min. and the tapping speed is 45 ft. per min. The floor to floor time is 24 seconds.

Each unit is equipped with individual motors with individual overload and underload protection. A central control is also provided which enables the entire machine to be started and stopped by means of a push button.

The lubricant distribution system is operated by a commercial turbine pump equipped with individual motor drive and controls, the pump being mounted at the back of the machine. One of the machine-pedestals constitutes a tank for the storage of lubricant. This particular operation requires the cutting tools to over-lap each other in the same hole, the cams controlling the feeds of the individual units being arranged to provide an interlocking action on the tools. This arrangement necessitates a positive and accurate control of the feeding mechanism, which is obtained by means of a hand valve located at the right front of the machine. The valve controls the action of an air cylinder attached to the tripping levers of the individual heads, insuring instantaneous operation and the elimination of tool hazards.



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Bench Lathes
For Turning—Drilling Grinding—Milling—Threading—Filing—Polishing—in the tool room or in production.

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B. C. AMES COMPANY, Waltham, Mass.
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"---the best Investment in our Equipment"

THAT'S the reputation the RHODES "Convertible" Horizontal Shaper and Vertical Slotter has earned in hundreds of plants throughout industry, because it is a convenient tool for handling a wide range of work ordinarily done on larger machines. And it produces work with a degree of accuracy, speed and economy that can't be beat. Use a RHODES "Convertible" in your shop and *you*, too, will say, "It's the best investment in our equipment." Write for bulletin!

THE RHODES MFG. CO.
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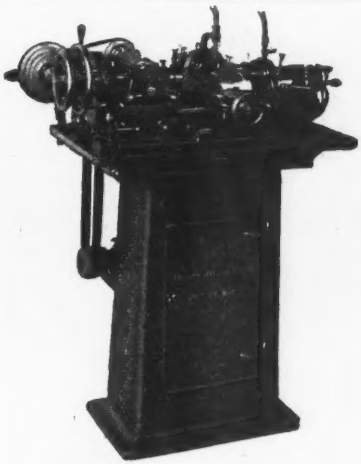

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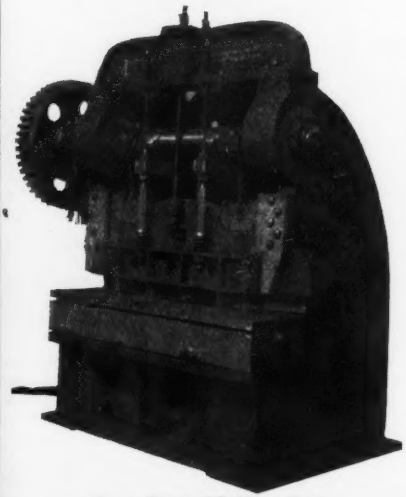

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STEEL PRESS BRAKES
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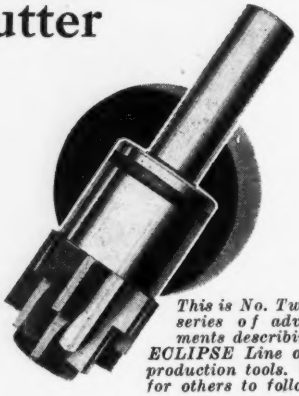
POWER PRESSES

Eclipse HIGH PRODUCTION TOOLS

The Multi-Diameter Cutter



This is No. Two of a series of advertisements describing the ECLIPSE Line of high production tools. Watch for others to follow.

THE Multi - Diameter cutter illustrated is used in one of Michigan's largest motor bus and truck factories.

It has eliminated several operations, one $2,250.00 machine, five cutters, the labor cost of one man and cut the former production time in half.

An ECLIPSE Multi-Diameter tool will make worth while savings in your production. Let us show you . . . Send the coupon for full information.

ECLIPSE COUNTERBORE CO.
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How will the ECLIPSE Multi-Diameter tool help my production? Send me full information.

Name .....
Firm .....
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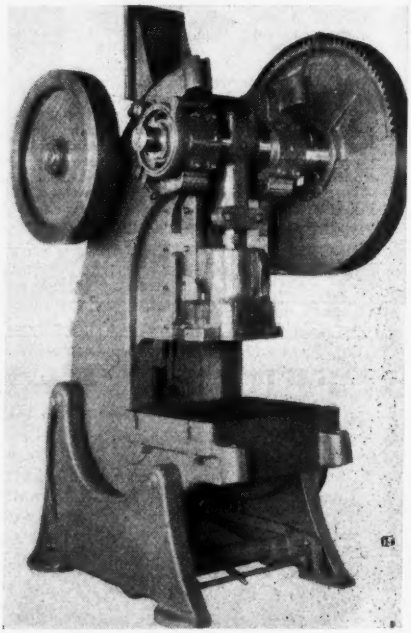
City..... State.....

Federal No. 7 Open Back Inclinable Press

The Federal Press Company, Elkhart, Indiana, has added another press, known as the No. 7, to its line of open back inclinable presses. The No. 7 press is made in both the flywheel and geared types, the one shown in the illustration being of the geared type. This press has a capacity of 75 tons and weighs 14,000 pounds. It is equipped with Timken roller bearings in the back gear bracket and has a bronze removable bushing in the flywheel. The crankshaft is 4¾ in. diameter at the main bearings and 5½ in. diameter at the crank pin.



Federal No. 7 Inclinable Press

The shaft is lubricated by large oil pockets in the caps from which felt pads carry the oil to the shaft, providing constant lubrication as long as the oil pockets are full. The press has a bolster area of 28 x 36 inches with a 13½-in. die space from bed to ram, stroke down adjustment up. The press shown is arranged for direct motor

TWENTIETH CENTURY BALANCING TOOL

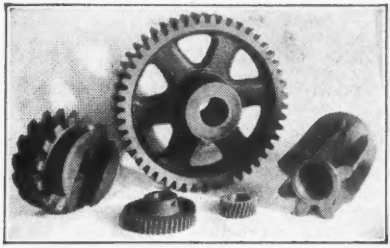
Always on the level

The most practical, sensitive and inexpensive device manufactured for balancing pulleys, cones, armatures, fly wheels, polishing wheels, etc. Will set anywhere and is easily portable. In sizes up to 24,000 pounds capacity.

Ask for the Bulletin

Sundstrand Machine Tool Co.
ROCKFORD, ILL.

GEARS



Mass. Gears

RECOGNIZED ACCURACY

All Types and in All Gear Materials.

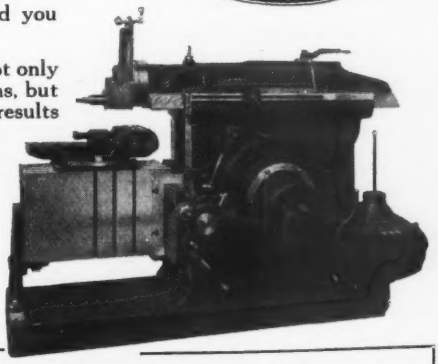
Massachusetts Gear & Tool Co.
27 Nashua St. Woburn Mass.

Cut Your Costs By Reducing Time!

Columbia SUPERIOR

Reduce the Time on any operation . . . and you reduce the *Cost!*

The COLUMBIA "Superior" SHAPER not only reduces the *Time* on your shaping operations, but does so *without sacrificing Accuracy!* Such results are possible because this tool has the weight and dimensions, properly proportioned, which enable it to withstand the working stress and maintain closer accuracy when operating at high speeds.



Let us tell you more of COLUMBIA Features . . . how they will reduce your operating time and costs. Write for Bulletin No. 17.

THE COLUMBIA MACHINE TOOL CO.
HAMILTON, OHIO

drive with motor bracket mounted on the top of the machine and the motor driving directly into the balance wheel. Care has been taken to obtain ease in operation and set-up, along with massive construction.

Bath Catalog No. 12, Third Edition of Ground Thread Handbook

John Bath & Co., Inc., Worcester, Mass., has issued Catalog No. 12, which constitutes the third edition of this company's "Ground Thread Handbook." The book comprises 176 pages, 5½ x 8 in., and includes descriptions and illustrations of the Bath products, tables of ground hand tap tolerances, a section devoted to approved gaging practice, a section of "Tapping Helps," definitions of threading and tap terms, tables of dimensions of standard taps, instructions for measuring pitch diameters of threads by the use of a micrometer and three wires, and many other handy and useful tables. The Bath products include ground thread taps, Acme and square thread taps, ground thread gages, ground thread rolling dies, thread chasers, Bath internal micrometer and master ring, and so on. Copies free to machine shop executives.

Ruthman 1930 Gusher Coolant Pump Catalog

All the various types and styles of Gusher Coolant Pumps manufactured by The Ruthman Machinery Company, 532 East Front Street, Cincinnati, Ohio, are described and illustrated in the 1930 Gusher Coolant Pump Catalog, issued by this firm. Photographs of the pumps are supplemented by cross section drawings showing the details of construction. Tables of specifications are included, in which are listed the dimensions, pumping capacity, horse power required, and size of motor required to operate each size of pump. Several pages of illustrations are also included, showing applications of Ruthman Gusher Coolant Pumps to all different types of metal working machines.

Lufkin Tool Co. Machinists' Tool Catalog No. 6

The Lufkin Rule Company, Saginaw, Michigan, has issued a catalog which is confined to the products of its Small Tool Division; i. e., machinists' fine tools. The catalog is designated as the No. 6, and includes full descriptions and illustrations of micrometers, calipers, dividers, combination squares, steel scales, depth gages, thickness gages, radius gages, screw pitch gages, hook rules, bevels, center punches, and so on. The book also contains several handy reference tables. Copies will be sent to readers of Modern Machine Shop without charge.

Siewek Jig Catalog

The complete line of "Rapid" Drill Jigs made by the Siewek Tool Company, 10232 Woodward Ave., Detroit, Michigan, is described and illustrated in a new catalog that has been issued by this company. The book contains 30 pages devoted to complete descriptions and specifications for Siewek Spring Jigs, Rack-and-Pinion Type Jigs, Four-Port Jigs, Jigs with adjustable tables, bushing plates, and locks for application to jigs and fixtures that are made in the customer's own plant. A number of illustrations showing applications of Siewek Drill Jigs are included.

Knurling In the Shaper

(*Continued from page* 66)

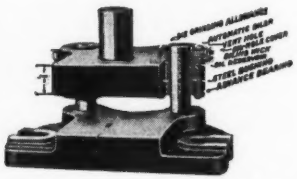
posite to the angle of the serrations in the upper die. After the return of the ram, the piece of stock to be knurled is placed in position on the lower die and as the ram feeds forward, the piece is rolled between the dies and the design of the knurl is rolled into it. As the upper die clears the lower one, the work is released. Dies of this type can be used to produce various kinds of designs on round stock, and will produce at a rate of speed much higher than any other method with which the writer is acquainted.

Mention MODERN MACHINE SHOP when writing advertisers. You will be co-operating with us, and then we can co-operate better with you.

BAUMBACH

Automatically Oiled

DIE SETS



Standardized die sets, embodying many exclusive features, and a listing of 70,000 stock sizes afford a service that is unsurpassed.

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A Difficult Job Made Easy

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We also manufacture Drillpointers, Point Thinners, Tap and Cutter Grinders.

SEND FOR BULLETINS TODAY.

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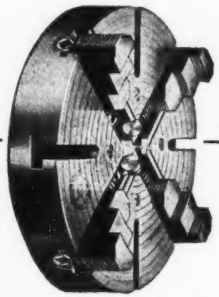
1430 MAUMEE ST., ADRIAN, MICH.



Union All Steel Independent Chuck No. 264. Made in ten sizes—6" to 42".

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Use UNION CHUCKS for
ACCURACY and ENDURANCE

FOR twenty-five years and more, twenty thousand Union No. 264 all steel independent chucks have been sold . . . *but not one has broken while in actual service!*

This record proves the service of the No. 264 Union Chuck . . . for as far as we know it is the only steel body chuck originally designed as such. Jaw slots are wider and screws are larger.

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Check any of these useful publications that you want, write your name, firm name, title, and address on the margin, then tear out the page and send to Modern Machine Shop, 128 Opera Place, Cincinnati, Ohio. They will be forwarded to you promptly without cost or obligation. Please restrict your list to not more than ten.

Abrasive Grinding Wheels: The types of wheels, with recommended grades and grains, which should be used for each of the various kinds of grinds are discussed in a booklet which will be sent free to mechanical executives by the Abrasive Company, Philadelphia, Pa.

Aetna Thrust Ball Bearings: Catalog No. 8, published by the Aetna Ball Bearing Manfg. Co., 4610 Schubert Ave., Chicago, Ill., contains complete descriptions and illustrations of the thrust ball retainers made by this firm. Copy free upon request.

Broaching By Modern Methods: Equipment and tools for finishing round, square or irregular-shaped holes and surfaces by broaching are described and illustrated in a booklet that is issued free by the American Broach & Machine Co., Ann Arbor, Michigan.

Ames Dial Gages: The latest types of dial gages for inspection purposes are described in the Ames No. 55 Bulletin, which will be sent free to any machine shop executive. Address B. C. Ames Co., Waltham, Mass.

Scraping By Power: Bearing surfaces can now be scraped with a power scraper that is quicker and easier than the old-fashioned hand method. The tool is described in a folder that is issued by Anderson Bros. Mfg. Co., 1926 Kishwaukee St., Rockford, Ill. Sent free on request.

Steel Furniture for the Shop: The complete line of steel furniture made by the Angle Steel Stool Co., Plainwell, Michigan, including steel stools and chairs, steel foremen's desks, lockers, tables, tool stands, machine tenders, shop boxes and pans, iron bar racks, trucks, bench legs, and bench drawers, is described and illustrated in Catalog "C," which is issued free to machine shop executives.

Stop Tap Breakage: A booklet that tells how to stop the breakage of taps, reamers, and other tools, by the use of a friction chuck, also how to use the chuck for setting studs or nuts, has been issued by The Apex Machine Co., 200 Davis Ave., Dayton, Ohio. Sent free upon request.

Machine Shop Accessories: Catalog B-27, issued by the Armstrong Bros. Tool Co., 328 N. Francisco Ave., Chicago, Ill., describes the line of tool holders, boring tools, wrenches, pipe tools, ratchet drills, lathe dogs, and other tools manufactured by this company.

Metal and Wood Saws: Catalog No. 20 describing saws of all kinds, for both metal and wood. 256 pages of descriptions of saws and sawing machinery. E. C. Atkins & Co., 402 S. Illinois St., Indianapolis, Ind.

Hold Odd-Shaped Pieces Securely: A vise in which odd-shaped work can be held securely without the need of special jaws or fixtures is described in a folder that has been issued by The Avey Drilling Machine Co., P. O. Box 487, Cincinnati, Ohio. Copy free upon request.

Hobs and Milling Cutters: A complete line of milling cutters and hobs for cutting all kinds of gears, splines, sprockets and other forms is described in Catalog G, issued by the Barber-Colman Company, Rockford, Ill. Descriptions and illustrations of the Barber-Colman hobbing machine and hob-sharpening machines are included. Sent free on request.

All-Geared Drilling and Tapping Machines: A catalog describing in detail the various types of all-geared, self-oiling, drilling and tapping machines made by the Barnes Drill Co., 801-851 Chestnut Street, Rockford, Ill., will be sent free upon request.

Modern Drilling Equipment: Circulars describing the various types and sizes of Barnes upright drills, multiple drills and horizontal drilling machines made by this company have been issued by the W. F. & John Barnes Co., Rockford, Ill.

Automatic Oiled Die Sets: The automatic oiled die sets, die shoes, punch holders, leader pins, bolster plates, bushings, and other standard die parts made by the E. A. Baumbach Manfg. Co., 1806 S. Kilbourn Ave., Chicago, Ill., are described in Catalog No. 5, which has been issued by that company. Sent free upon request.

"C-V" Chrome Vanadium Wrenches: A complete line of wrenches made of Chrome Vanadium steel—practically unbreakable—is described in a booklet that has been issued by the Bonney Forge & Tool Works, Allentown, Pa. Copy free upon request.

Bradford Precision Lathes: Precision Lathes for the tool room and for general manufacturing purposes, all-geared and cone types, belt or motor driven, are described and illustrated in a catalog that is issued by The Bradford Machine Tool Co., 657-671 Evans St., Cincinnati, Ohio. The catalog also includes descriptions of taper, relieving, turret and other lathe attachments. Sent free upon request.

How To Sharpen Staggered Tooth Cutters, Helical Milling Cutters, and Two-Lipped End Mills: A series of pamphlets on these subjects can be obtained without charge by addressing the Brown & Sharpe Mfg. Co., Providence, R. I.

High Speed Drill Presses: A complete line of drill presses that can be run at high speeds with complete safety is described in catalog number 50, issued by the Canedy-Otto Manufacturing Company, Chicago Heights, Ill. This catalog also contains descriptions of other equipment manufactured by this concern. Sent free upon request.

Electric Tools: The complete line of "The Cincinnati" Electric Drills, Grinders, Buffers, etc., manufactured by the Cincinnati Electrical Tool Company, Cincinnati, Ohio, is fully described and illustrated in their new catalog. Free upon request.

Gear Data: The Cincinnati Gear Co., Cincinnati, Ohio, has published Catalog D, which describes and illustrates the various types and kinds of gears made by this firm. The book contains photographs of the plant departments, with descriptions of the equipment employed, and also includes a number of pages of valuable data and reference tables for machine shop use.

Grinding the Centerless Way: The advantages of the centerless grinding method is discussed in a booklet which also describes the centerless grinding machines made by Cincinnati Grinders, Inc., Cincinnati, Ohio. The illustrations show various types of jobs in process, and full data is included. Copy free upon request.

Rapid Traverse Planers: Cincinnati Hypro Planers, made by the Cincinnati Planer Co., Cincinnati, Ohio, are described in a new catalog that has been issued by this company.

Bolender Gear Burnishers: Gears will operate more smoothly and more silently if burnished. Full description of the Bolender Gear Burnisher can be had by addressing the City Machine & Tool Works, Third and June Sts., Dayton, Ohio.

Handbook For Drillers: The Cleveland Twist Drill Co., 1242 E. Forty-ninth St., Cleveland, Ohio, has published a book in which the various parts of the twist drill are described, and which tells how to grind a drill correctly. The troubles that result from incorrect grinding are described and illustrated and several chapters are devoted to the subjects of speeds, feeds, materials, cutting compounds, and so on. Sent free upon request.

Columbia Superior Shapers: Bulletin No. 17, issued by The Columbia Machine Tool Co., Hamilton, Ohio, describes and illustrates the line of heavy duty shapers made by this firm. Copy free upon request.

Columbia Tool Steel Handbook: A book containing valuable information concerning the making of tools, heat treating, uses of hardness testing instruments,

Cleanliness

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Come to Headquarters for

Grooved (*Cast Iron*) **Pulleys**

All Size Holes

Pulley Diam. inches	Size of Holes inches
2½	⅜ ½ ⅝
3	½ ⅝
4L	⅝ ½
4	½ ⅝ ¾ 1
5	½ ⅝ ¾ 1
6	½ ⅝ ¾ 1
8	½ ⅝ ¾ 1
10	½ ⅝ ¾ 1
12	½ ⅝ ¾ 1

Special Holes Bored

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LUFKIN TOOLS

THEIR high degree of accuracy justifies their constantly increasing popularity.

Calipers, Micrometers, and Gauges to cover all machine shop requirements.

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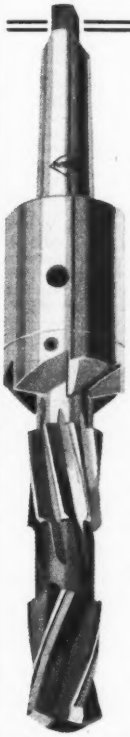
SMALL TOOL DIVISION

SAGINAW, MICHIGAN

SAVE LABOR WITH MIDWEST TOOLS



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The tool illustrated combines four operations in one....it drills, reams, spot faces and chamfers.

The Midwest Pin Drive is also an outstanding feature of the Midwest tools. This drive is a solid and accurate drive which eliminates all chance of breakage, gives extra long service and enables you to work to closer limits.

Here is a method which will cut your costs....get the details....write for a catalog!

Midwest Tool & Mfg. Co.

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uses of the quenching bath, drawing bath, and other heat treating equipment, and together with tables and other useful information can be obtained without charge by addressing the Columbia Tool Steel Co., 550 E. 14th St., Chicago Heights, Ill.

Broaching for Profit: A combination round and spline broach which broaches the drilled hole to size, cuts the splines, and removes the burrs in one operation is described in a circular which will be sent free by The Connecticut Broach & Machine Co., New London, Conn.

Die Makers' Supplies: A complete line of die sets, leader pins, bushings, and other die makers' supplies are described in a book that is issued by the Danly Machine Specialties, Inc., 2104 South 52nd Avenue, Chicago, Ill. Sent free upon request.

Davis Keyseaters: Recent developments in keyseating methods are discussed in a bulletin that also describes the keyseaters made by the Davis Keyseater Company, 250 Mill St., Rochester, N. Y. Copy free upon request.

Grinding Wheel Dressers: All of the different types of grinding wheel dressers made by the Desmond-Stephan Mfg. Co., Urbana, Ohio, including Desmond-Huntington, Desmond-Sherman, Zig-Zag, Diamo-Carbo, and diamond dressers, are described and illustrated in a catalog that has been published by the firm mentioned. Free upon request.

Precision Grinding: A booklet which describes and illustrates the most modern methods of performing all kinds of precision grinding operations, showing how the Dumore grinder can be applied to various kinds of machine tools, has been published by The Dumore Company, Racine, Wis. Copy free upon request.

Interchangeable High Production Tools: Catalog No. 28, issued free by the Eclipse Counterbore Co., 7410 St. Aubin St., Detroit, Mich., describes and illustrates the interchangeable counterbores, spot facers, end form cutters, and other end cutting tools made by this firm.

Grooved Cast Iron Pulleys: All sizes of grooved cast iron pulleys, made by Efficient Machine Shop, 147 Baxter St., New York City, are listed in a circular that can be had by writing this firm.

Precision Measuring Instruments: The latest types and models of dial indicators, thread lead test gages, pitch gages, thickness gages, dial comparators, and other precision measuring instruments marketed by the Federal Products Corporation, Providence, R. I., are described and illustrated in a book that will be sent free upon application to this firm.

"The Practical Art of Generating": A simple and practical analysis of the generating principle, showing how teeth are generated on all kinds of gears, is included in a book that has been issued by The Fellows Gear Shaper Co., Springfield, Vt. Copy free upon request.

Questions To Ask Before Buying a Jig-Boring Machine: A list of the fine points to look for in a jig-boring machine, with descriptions and illustrations of the working parts of the Swiss Jig Borer, can be obtained free by addressing The R. Y. Ferner Co., 1511 K St., N. W., Washington, D. C.

Formica Silent Composition Gears: A booklet telling about the uses and advantages of Formica Silent Shock Absorbing Gears, and containing a considerable amount of valuable data with rules and tables for laying out, cutting and using gears. Sent free by Formica Insulation Co., 4632 Spring Grove Avenue, Cincinnati, Ohio.

Fosdick Drills: This publication gives details as to the design and construction of Fosdick Radial, Upright, and Sensitive Drills. Published by the Fosdick Machine Tool Co., Cincinnati, Ohio.

Gear Problems: Catalog No. 203, published by the Foote Bros. Gear & Machine Company, Dept. 68, 111 No. Canal St., Chicago, Ill, is intended to serve as a complete reference work for all users of gears or speed reducers. Full instructions for figuring gears, sprockets, chains, etc. are included. Copy free to any mechanical executive.

Modern Grinding Equipment: The complete line of universal tool and cutter grinders, surface grinders, drill grinders, tap grinders, and other grinding machines made by the Gallmeyer & Livingston Co., 336 Straight St., S. W., Grand Rapids, Michigan, is described in a series of bulletins that have been issued by this firm. Free upon request.

Adjustable Blade Cutters: Hollow mills, facing tools, face mills, milling cutters and other production tools with adjustable, interchangeable blades are described and illustrated in a booklet that is issued free by the Genesee Manufacturing Co., 141 N. Water St., Rochester, N. Y.

Machine Vises of all sizes for use with machine shop equipment are described in a circular that will be sent free upon application to The Graham Mfg. Co., 69 Willard Ave., Providence, R. I.

Greaves-Klusman Lathes: A book containing complete descriptions of the latest types of lathes made by this firm has been issued by the Greaves-Klusman Tool Co., Oakley, Cincinnati, Ohio.

Swiss Files: The complete line of Grobet Swiss Files for use in die and tool work or for other fine work is described and illustrated in Catalog "K," published by the Grobet File Corporation of America, 3 Park Place, New York, N. Y. Copy free upon request.

Drawing Tables: The Hamilton steel-base, adjustable drawing table is described in Catalog No. 7-MS, issued by the Hamilton Mfg. Co., Two Rivers, Wis. Copy free upon request.

Grinding, Polishing and Buffing Machines of the latest types are described and illustrated in a series of bulletins that have been issued by the Hammond Machinery Builders, Kalamazoo, Mich. Copies free upon request.

Flexible Shaft Equipment Eliminates Hand Labor: Files, drills, grinding wheels, and other tools can be mechanically operated by the use of the flexible shaft equipment manufactured by the R. G. Haskins Co., 4653 W. Fulton St., Chicago, Ill. Catalog free upon request.

Drilling and Grinding Electrically: Catalog M, showing and describing a variety of modern electric portable drills, grinders, and other tools, including floor grinders and buffers, has been issued by The Hisey-Wolf Machine Co., Colerain and Marshall Sts., Cincinnati, Ohio.

Speed Reducers: A catalog of speed reducers up to 200 h.p. and built to deliver any ratio desired in standard size units can be obtained by addressing The Horsburgh & Scott Co., 5110 Hamilton Ave., Cleveland, Ohio. Give firm name.

"Houghton's Refrigerant Base" and "Hocut"—metal cutting oils manufactured by E. F. Houghton & Co., Philadelphia, Penna., are fully discussed, together with their outstanding properties, in two booklets which can be obtained without charge by addressing this firm.

"Do It Electrically": The complete line of "Thor" universal electric tools, including tools for drilling, reaming, screw-driving, tapping, nut-setting, grinding, and for performing other operations is described in Catalog No. 17, issued free by the Independent Pneumatic Tool Co., 236 S. Jefferson St., Chicago, Ill.

"Excel" Precision Filing and Sawing Machine: A filing and sawing machine for use in producing templets, dies and other irregular-shaped parts is described and illustrated in a booklet which is issued free by Index Machinery Corporation, 49 Central Ave., Cincinnati, Ohio.

Tool Steel Composition, Selection, and Heat Treatment: William Jessop & Sons, Inc., 121 Varick St., New York, N. Y., has published a series of pamphlets dealing with the above subjects. Copies free upon request.

Special Mil-Waukee-Mils of Standard Units: A milling machine of which the base, heads, columns, and other parts are built in standard units, thus enabling the user to order a machine that will be especially adapted for his job, is described and illustrated in Catalog No. 36, issued by the Kearney & Trecker Corporation, Milwaukee, Wis. Free to machine shop executives.

Koebel-Wagner Diamonds for Wheel Dressing: The Koebel-Wagner method of mounting diamonds and the use of the "Dykon" gage are discussed in a bulletin

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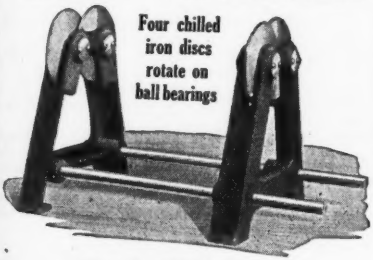

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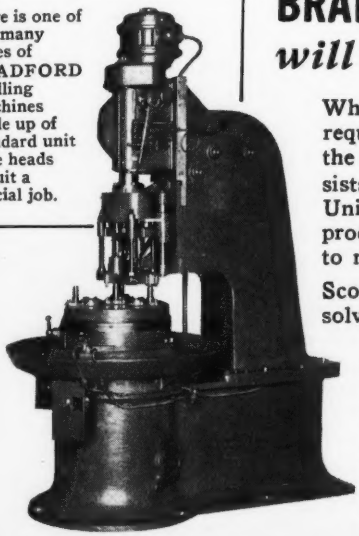

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issued by the Koebel-Wagner Corporation, 144 Orange St., Newark, N. J. Free upon request.

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Lathe Dogs and C Clamps are described and illustrated in Catalog No. 80, issued by the W. G. LeCount Tool Works, South Norwalk, Conn. Copy free upon request.

Air-Operated Work-Holding Devices: A booklet showing how air-operated chucks and devices of various kinds can be applied to different kinds of machines to save time and labor has been issued by The Logansport Machine Co., Logansport, Ind.

Punching and Shearing Operations: A complete line of machines for perforating and cutting metal in practically any size and shape is described and illustrated in a booklet which has been issued by The Long & Allstatter Co., Hamilton, Ohio. Copy free upon request.

Rapid-Reading Micrometer: A new type of rapid-reading micrometer, designed to show the reading in numerals, is described in Catalog No. 5, issued by The Lufkin Rule Co., Saginaw, Michigan. The catalog also contains descriptions of the micrometers, calipers, gauges, scales, squares, bevel protractors, and other tools made by this company. Free upon request.

Finish Irregular Surfaces the Modern Way: Irregular surfaces in dies, patterns, tools and other parts where the use of a file is difficult and laborious can now be finished quickly and neatly by the use of the Kipp Air Grinder. Catalog and prices upon request. Address Madison-Kipp Corporation, 219 Waubesa St., Madison, Wis.

"A Captain of Industry:" Pocket Handbook 23-P, issued by The David Maydole Hammer Co., Norwich, N. Y., tells how David Maydole came to make what he considered the best hammer in the world, and also includes descriptions of the various types of Maydole hammers. Several useful tables are included. Copy free upon request.

Gears: Quick service on gears in either standard or special sizes is available from the Massachusetts Gear & Tool Co., 27 Nashau St., Woburn, Mass. Particulars upon request.

Time Saving Machine Equipment: How machining time can be reduced to the minimum by the use of Wizard chucks, collets and tap holders, turret tool posts, self-centering steadyrests, and other McCrosky equipment is told in a book that is issued by the McCrosky Tool Corporation, Meadville, Penna. Will be sent without charge.

Midwest Pin Drive Keyway Cutters are described and illustrated in a catalog that can be had by addressing Midwest Tool & Mfg. Co., 2362 West Jefferson Ave., Detroit, Michigan.

Polish at Any Speed: The Mitchell motor-driven polishing lathe, in which herringbone gears are used to transmit power from the motor shaft to the lathe spindle, can be operated at any desired speed. Bulletin can be obtained by addressing the Mitchell Engineering Co., Springfield, Ohio.

Nateo Drilling, Tapping, and Boring Equipment is the title of a publication that has been issued by The National Automatic Tool Co., Richmond, Ind. The book gives details as to construction and uses of "Nateo" multiple drilling and tapping machines.

Milling Internal Keyways: A simple method of milling keyways in gears, wheel hubs, and other similar parts with the aid of a drill press and a special tool is explained in a booklet that is published by the National Machine Tool Co., 2271 Spring Grove Ave., Cincinnati, Ohio.

"The Answer to Your Gear Problems": Information as to correct methods of cutting and finishing gears will be supplied without charge by The National Tool Co., Cleveland, Ohio. This firm also carries a complete stock of gear shaper cutters and markets the National-Cleveland Spur and Helical Gear Grinding Machine.

Save Time with Expanding Mandrels: How expanding mandrels will solve the problem of turning pieces with odd-size holes, and will increase production on duplicate work, is told in a folder that will be sent free upon request by W. H. Nicholson & Son, 136 Oregon St., Wilkes-Barre, Pa.

Live Centers: The complete line of live centers manufactured by Nielsen, Inc., of Lawton, Mich., are fully described in a bulletin issued by this company. This bulletin is illustrated with photographs and blueprints of the Nielsen Center. Mailed free upon request.

Ball and Roller Bearing Data Sheets: A complete set of data sheets showing all the dimensions and loads at given speeds, and giving instructions for mounting precision ball bearing and Hoffmann roller bearings, can be obtained without charge by addressing the Norma-Hoffmann Bearings Corporation, Stamford, Conn.

How To Grind Cemented Tungsten Carbide: A booklet which describes and illustrates the correct methods of grinding tungsten carbide tools has been published by the Norton Company, Worcester, Mass. Copy free upon request.

Correct Cutter and Tool Grinding: Grinder Booklet "E," which is illustrated with 48 photographs, tells how to grind tools correctly and economically. It shows how a solid-backed cutting edge reduces cutter costs and increases production per grind. A copy will be sent free by addressing The Oesterlein Machine Company, 3301 Colerain Avenue, Cincinnati, O.

Speed Reducers: Speed Reducers to obtain any desired reduction up to 24,000 to 1 are described and illustrated in Catalog 29-A, issued by The Ohio Gear Co., 1335 East 179th St., Cleveland, O. Copy free upon request.

Die Making Machines: How dies, templates, gages, etc., can be sawed out, filed, and lapped easily and accurately on Oliver die making machines is fully described in a bulletin issued by the Oliver Instrument Company, 1430 Maumee Street, Adrian, Mich. Mailed upon request.

Self-Tapping Sheet Metal Screws: Screws which are threaded and hardened in such a manner as to enable them to cut their own threads as they are screwed into sheet metal assemblies are described in a folder which is published by the Parker-Kalon Corporation, 192-196 Varick St., New York City, N. Y. Sent free upon request.

Powell "Blo-Gun" Air Valves: Air is faster and more efficient than a brush for cleaning machine tables. The use of the Powell Blo-Gun for this purpose is discussed in a catalog that can be obtained by addressing The Wm. Powell Co., Cincinnati, O.

Tapping Devices, Quick-Change Chucks, Stud-Setting Tools and Bench Tappers: A catalog describing the various types and kinds of tapping, drilling, and stud-setting devices manufactured by the Procunier Safety Chuck Company, 12 South Clinton Street, Chicago, Ill., can be obtained without charge by addressing this company. The catalog also tells the part that Procunier tools play in obtaining greater accuracy and less tap breakage.

Engine, Turret, and Gap Lathes are described in a series of bulletins that have been issued by The Rahn-Larmon Co., 2935 Spring Grove Ave., Cincinnati, Ohio.

Shape or Slot With This Machine: The Rhodes Convertible Shaper, made by The Rhodes Manfg. Co., Waltham, Mass., can be used for horizontal shaping or vertical slotting. Details upon request.

Fullmore Industrial Clutch: A multiple disc clutch, made in two types, to run in oil or dry, and which is so built that it can be operated at high speeds, is illustrated and described in a folder that will be sent free by the Rockford Drilling Machine Company, Rockford, Ill.

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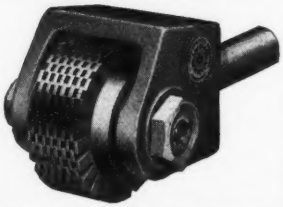

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WITH A

Koza Right Angle Drill

WHEN it is necessary to put in a hole or drill out a broken bolt in a hard-to-get-at-place — a Koza Right Angle Drill or Grinder will prove itself worth its weight in gold.

Koza Right Angle Drills and Grinders eliminate the necessity of tearing down a machine, to reach the broken bolt or part, by drilling around the corner — at right angles.

These tools may be used for drilling, keywaying or countersinking. There is a tool for every requirement—in every industry.

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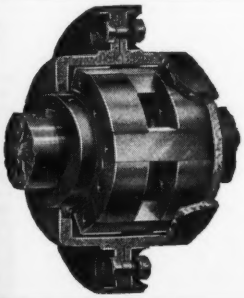

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for folder to Rockford Machine Tool Co., 2414 Kishwaukee Ave., Rockford, Ill.

Automatic Lubrication: Individually motor-driven pumps that keep the work flooded with lubricant are described in a booklet that has been published by the Ruthman Machinery Co., Front and Pike Sts., Cincinnati, Ohio.

Safety Grinding Wheels: The complete line of grinding wheels made by the Safety Grinding Wheel & Machine Co., Springfield, Ohio, is described in Catalog No. 11, which is issued by this firm. The book also contains instructions for operating grinding wheels, tables of grinding wheel speeds, pulley calculations, and other information for the user of grinding wheels.

Equipment For the Shop: Vises for the bench, drill press, milling machine or shaper; angle plates; adjustable clamps, jacks and other tools for the machine shop, are described and illustrated in a booklet that is published by the Sheldon Machine Co., 3253-55 Cottage Grove Ave., Chicago, Ill. Copy free upon request.

Economies in Material Handling: A volume of facts about planned load handling, with actual examples of economies in time, material, and labor costs that have been effected with Shepard electric hoists will be sent free upon request to Shepard Niles Crane & Hoist Corp., 424 Schuyler Ave., Montour Falls, N. Y.

Rapid Drill Jigs: How time can be saved and drilling operations made easier by the use of a quick-acting drill jig is told in a booklet that is issued free by the Siewek Tool & Die Co., 10230 Woodward Ave., Detroit, Michigan.

"Metal Cutting" is the title of the book that describes the latest methods of cutting metals, and includes descriptions and illustrations of both the band saws and inserted-tooth metal-cutting saws made by the Simonds Saws & Steel Co., Fitchburg, Mass. Copy will be sent free upon application to the firm mentioned.

The Most Efficient Speed for the operation of special production units, power conveyors, and other machinery by the use of the WHS Speed Reducer and how it can be obtained is told in a bulletin that will be mailed free by Winfield H. Smith, Inc., 30 Eaton St., Springville, N. Y.

Shaping with Modern Equipment: The Smith & Mills Company, 2889-91 Spring Grove Avenue, Cincinnati, Ohio, has issued a booklet which describes and illustrates the line of modern shaping equipment made by this firm. Copy free upon request.

Accurate Gages Speed Production: The complete line of snap, plug, ring, pin, dial indicator, and special gages made by the Standard Gage Co., Inc., Poughkeepsie, N. Y., is described and illustrated in Catalog No. 4, which can be had without charge by addressing this firm. Johansson gage block sets and accessories are also listed in this book.

Machinists' Tools and Gages: Catalog No. 24, issued by the L. S. Starrett Co., Athol, Mass., describes and illustrates the complete assortment of machinists' fine tools and gages made by this firm. Copy free upon request.

Flexible Shaft Equipment: The uses of the flexible shaft for drilling, grinding, and other operations is discussed in a booklet which also describes and illustrates the flexible shaft equipment made by N. A. Strand & Co., 5001 N. Lincoln St., Chicago, Ill.

Cutting Oil Data: A series of booklets containing valuable information about cutting oils and their uses for thread-cutting, broaching, and general cutting purposes will be sent free to any mechanical executive by D. A. Stuart & Co., 2727 South Troy St., Chicago, Illinois.

Precision Measuring Instruments: The gages, micrometers, and other precision measuring instruments made by the Swedish Gage Co. of America, 7310 Woodward Ave., Detroit, Mich., are fully described in an interesting booklet that has been published by this firm. Copy free upon request.

Snap, Plug, Ring, and Thread Gages: The complete line of precision gages made by The Taft-Peirce Manufacturing Co., 32 Mechanic Ave., Woonsocket, R. I., is described in a folder which can be obtained, free, by addressing this company.

Chuck With Air: How time and labor can be saved by the use of air-operated chucks, cylinders, and other equipment is told in a book which describes "Hopkins" Air-Operated Equipment. Published by The Tomkins-Johnson Company, 620 N. Mechanic St., Jackson, Mich. Sent free upon request.

A Simplified and Improved Drive Control for Machinery: Two distinct types of plate clutches that have proved successful highly in the driving mechanism of machine tools are described and illustrated in a bulletin that will be sent free by the Twin Disc Clutch Company, Racine, Wis.

Powerful, Easy-Acting Chain Hoists of the most modern design are described and illustrated in a booklet that is issued by the Union Manufacturing Co., 296 Church St., New Britain, Conn. Copy free upon request.

Multiple Drilling With a Single-Spindle Drill: Methods by which multiple drilling may be done on a single-spindle drill, using multiple spindle drill heads, are discussed in a bulletin that is issued by The United States Drill Head Co., 1954 Riverside Drive, Cincinnati.

Electrically-Driven Portable Tools: The "U. S." line of electric drills, die grinders, electric screw drivers, surface grinders, tool post grinders, and bench and floor grinders is described in Catalog No. 24, which has been published by The United States Electrical Tool Co., 2471 W. Sixth St., Cincinnati, Ohio.

Eliminate Clamping Time: Work can be held without clamps on grinders, planers, and other machines by the use of Walker Magnetic Chucks that are described and illustrated in a series of folders that have been issued by the O. S. Walker Co., Inc., Rockdale St., Worcester, Mass. Copies free upon request.

Accuracy in Thread Production: How accurate threads can be produced by the thread miller is told in a pamphlet that can be obtained free by addressing the Waltham Machine Works, Box 296, Waltham, Mass.

Tool Chests for Machinists and Toolmakers: The complete line of fine tool chests for machinists and toolmakers made by J. M. Waterston, 420 Woodward Ave., Detroit, Mich., is described in Catalog No. 25. Ask for it.

Screw Machine Products: Full information as to the manufacturing service on screw machine products maintained by Western Screw Products Co., 19-31 St. George St., St. Louis, Mo., will be sent upon request.

Wetmore Adjustable Reamers: The exclusive features of the Wetmore Adjustable Shell Reamer are discussed in Catalog No. 29, issued by the Wetmore Reamer Co., 62 27th St., Milwaukee, Wis. Copy free upon request.

Drill Horizontally: The advantages of the "Whirlwind" Horizontal Drilling Machine for high speed drilling on small work are discussed in a bulletin which has been issued by Whirlwind Products Co., 1737 Ludlow St., Indianapolis, Ind. Copy free upon request.

Whiton Steel Body Lathe Chucks: The various types and sizes of steel body chucks for lathes that are made by the D. E. Whiton Machine Co., New London, Conn., are described and illustrated in a booklet that will be sent free upon application to this firm.

Wrenches For Every Use: "Guaranteed Against Breakage" tappet wrenches, pipe and fitting tongs, offset wrenches, and wrenches for all other uses are described and illustrated in a series of folders which can be obtained without charge by addressing J. H. Williams & Co., Buffalo, N. Y.

"An Inspection Tour of Industrial Plants" is a booklet published by Wilson-Maeulen Co., Inc., Concord Ave. & 143rd St., New York, N. Y., showing the heat-treating equipment in use in a number of industrial plants, and discussing the manner in which such equipment is automatically controlled. Copy free upon request.

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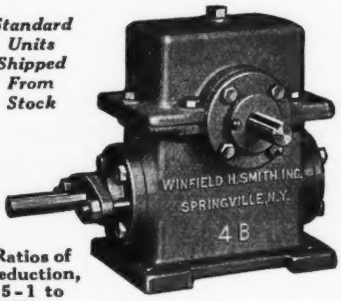

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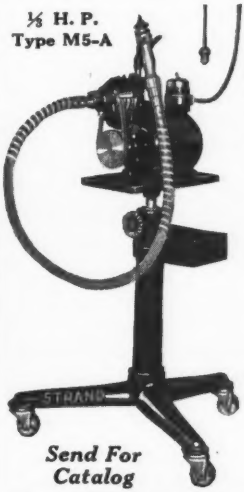

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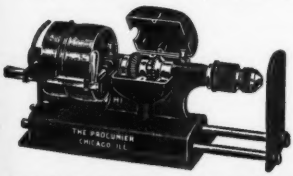

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will solve them. It has bronze bushings, a real safety device, and tap holder, and all hardened reverse gears.

No. 2—7/16″ in steel, with friction, $49.00, without, $41.00
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We also make safety tapping attachments for drill presses, and quick change tap and drill chucks.

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THE SCRAP PILE

By GEO. ALEXANDER MANN

Steno Liz Sez

The boss is sure a grouch,
Today he called me down,
Because he said I put
A period upside down.

The biggest sap we've heard about for some time is the poor egg who after watching four dog races, rushed to the betting shed an' tried to bet two dollars on the rabbit.

Ain't Ut Turrible?

They useta dance trots,
Then went from trots to skips,
Now 'bout all they do
Is stutter with their hips.

Great Place For Stag Parties

What a kick the Eskimo husbands, with nights six months long, must get out o' the song "We Won't Go Home Until Morning."

She's a Bear-cat

I got another sweetie,
With lotsa good points,
She is a butcher's daughter
An' knows all the joints.

Long skirts are tuff on the poor guy with a rotten memory an' no imagination.

We have no little fairy in our home —but we have a little made in our cellar.

Wimmin' useta take us for better or worse—now it's for more or less.

A Sugar Baby

They throw away their money
When her lips she puckers.
She's a candy maker's daughter
An' she knows her suckers.

It's sure hard to understand the janes fallin' for them long dresses—they make 'em look so effeminate.

At the Shore

"They've dropped their anchor,"
He said to Miss De Lang,
She said, "No wonder,
The way they left it hang."

The young husband-to-be don't know which is the tougher—popping the question or questioning the pop.

They Come Right Back

The trouble with us is that when we throw off our bad habits we put too much back-spin on 'em.

Ain't He Good?

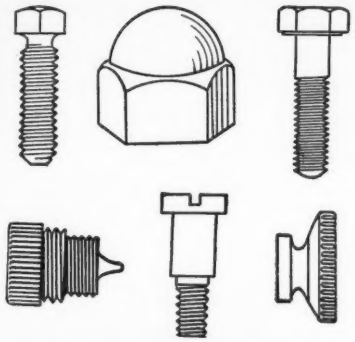
The amateur gard'ner,
Is hard to match,
He finds he's pickin' rhubarb
From his radish patch.

No intelligent husband will exercise his right till he knows somethin' 'bout his wife's left.

Western Screw-Products Co.

Screw Machine Products
Hex. Head Cap Screws

SET SCREWS CASTLE NUTS



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OILDIE NON-SHRINKING
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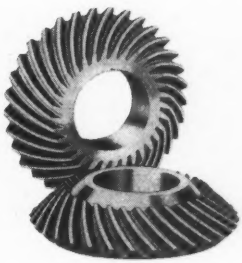

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Show up best

To meet adequately present day demands for *speed* and *rigidity*.... gears must be accurate!

And, that is where CINCINNATI GEARS show up best. They are cut to close limits.... smoothly finished....and rigidly inspected.

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The Cincinnati Gear Co.
1825 READING ROAD
CINCINNATI, OHIO

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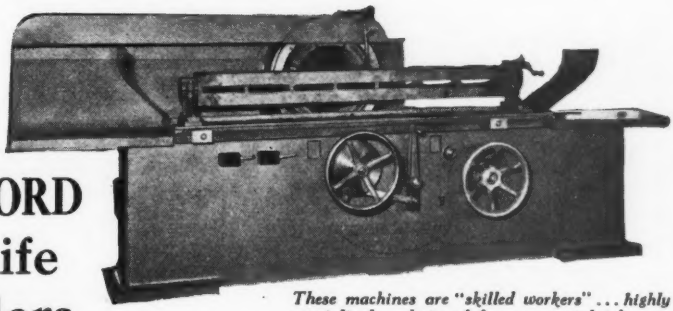
SAFETY Ring-Wheel Automatic Knife Grinders



the LAST WORD in Knife Grinders

These machines are "skilled workers" . . . highly specialized . . . designed for one special job . . . to grind any straight-edged knives and shear blades with the utmost ease, speed and economy. Made in sizes 50 to 130 inch capacity, belt or motor driven.

accurate . . . convenient . . . rigid

This new line of SAFETY Knife Grinders has three outstanding characteristics: sturdy *rigidity*, extreme *accuracy* and unequalled *convenience* of operation.

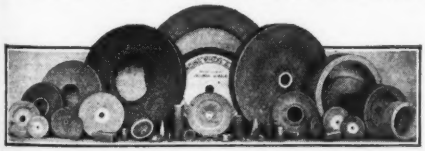
RIGIDITY OF CONSTRUCTION

You will be impressed at first sight with the clean design and sturdy, rugged construction of these Knife Grinders. Every part is built heavier and stronger than is normally required . . . of the very finest material . . . with the most finished craftsmanship . . . to give a lifetime of care-free service.

ACCURACY OF WORK

Solid construction throughout, heavy, accurately-aligned bearings on the Knife Bar, the design features of the standard rotative Knife Bar, the positive table drive and micrometer head feed . . . all these features combine to result in new standards of accuracy in grinding straight-edge knives and shear blades.

"A wheel for every need" . . . backed by 37 years' experience



CONVENIENCE OF OPERATION

These machines may be operated from front or rear. On motor-driven machines both the grinding wheel and table are started and stopped by push-button control, mounted on both front and rear of the machine. Adjustable, automatic feeds for both table stroke and head feed (depth of cut) are provided. The water supply tank is *separate* from the machine, located out of the way, yet readily accessible, easily carried to a convenient place for thorough cleaning, thus eliminating this mess and inconvenience about the machine.

GET COMPLETE FILE DATA

Make a note to send for our new Bulletin K-301, which explains in detail the various important items of superiority in this line of machines. Detailed comparison of this equipment, point by point, will make clear to you why these SAFETY Ring-Wheel Automatic Knife Grinders have made such a favorable impression wherever they have been shown . . . have demonstrated such remarkable economies wherever they have been installed. Write *today* . . . while you are thinking about it.

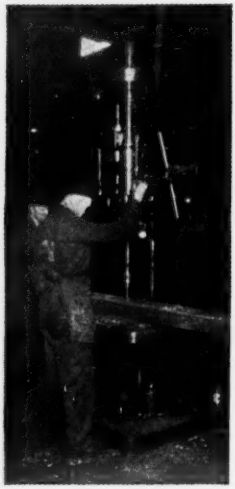
The Safety Grinding Wheel & Machine Co.
2374 Columbus Ave. Springfield, Ohio

Can I Justify My Drill Purchases by "COST PER HOLE" DRILLED?

SAVINGS in drill cost, amounting to hundreds, even thousands of dollars per year on a single drilling operation, are being made as a result of selecting drills by the "*cost per hole*" method.

One large machinery manufacturer chose the most difficult job in his plant for the test. Cle-Forge High Speed Drills and one other make costing twice as much were set to the job of drilling bars of high carbon manganese steel.

When the final check-up was made, it was found that both drills could be ground the same number of times, but that Cle-Forge Drills gave 60 holes per grind against 27 by the other drill. Cost per hole for Cle-Forge was .0028. For the competing drill, .0064. By using Cle-Forge Drills on this job $972 were saved in one year.



Many plants have written us for information since we first introduced the "*cost per hole*" method of selecting drills. Have you received complete forms and instructions for making this test in your plant? The coupon below will bring them to you. No obligation is implied.

The CLEVELAND TWIST DRILL COMPANY CLEVELAND
NEW YORK-CHICAGO-LONDON SAN FRANCISCO
TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES

SPECIALISTS IN TWIST DRILLS AND REAMERS

Yes, we would like to receive forms and instructions for making the cost per hole test. Also Digest No. 82.

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*CV (Chrome-Vanadium)
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ALLENTOWN, PA.
Makers of Special Service Wrenches of Chrome Vanadium, Carbon Steel Drop Forged Wrenches, Pipe Wrenches, Vises and Drop Forgings and the Bonney Rim Tool.
Patents Pending

THE STANDARD OF QUALITY
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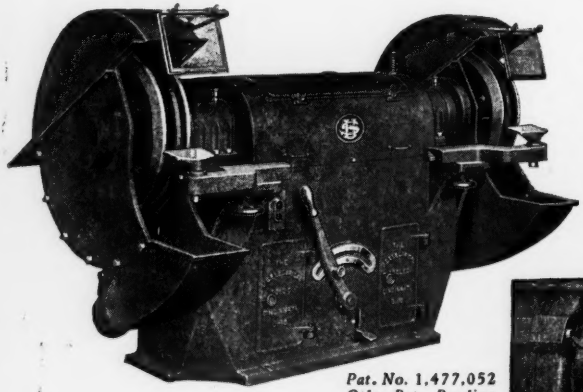
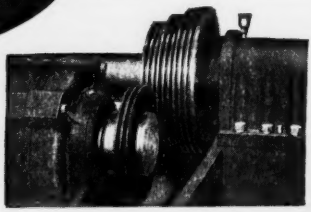


Pat. No. 1,477,052
Other Pats. Pending

THE DRIVE

The Gibbs V-Disc Transmission — made of GRAPHITIZED MICARTA — shows highest efficiency in power transmission — is dependable and positive in action—will not slip — is free from back lash — readily accessible — quiet — durable — low in replacement cost — easy to operate — and economical.



No Other Like It

ALL the big, new advantages of grinding with the Gibbs V-Disc Transmission are obtainable only in this machine. Now you can grind on alternating current—maintain a constant wheel surface speed regardless of wheel wear—and use the wheels clear down to the flanges. This is possible even with high speed wheels turning approximately 9,000 surface feet per minute!

THE U. S. VARIABLE SPEED A. C. GRINDER embodies all the advanced features of U. S. construction: SIX heavy duty SKF Ball Bearings. Heavy 1-piece chrome-manganese steel shaft, etc. And it is built in accordance with the Safety Code of American Engineering Standards Committee, Bulletin 436, U. S. Bureau of Labor Statistics! Ask your jobber for full details, or write us today.

BUFFERS, TOO—This drive is also obtainable in U. S. Multispeed Buffing and Polishing Machines—providing four different wheel speeds from 2,000 to 3,000 r.p.m.

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